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EDITORIAL

The Editorial Board is delighted to bring out the Volume 33 of Bulletin of Nepal Geological Society. This volume highlights the regular activities that the Society had performed since the publication of the previous volume. It also includes some scientific articles on various topics of geosciences and abstracts of the papers presented on IDDR Day -2015 and various other Scientific Talk Programmes organized by Nepal Geological Society.

We thank authors for contributing their valuable papers to this volume. Similarly, we thank all members of the Society for their continuous cooperation and participation in various activities organized by the Society. The Board also appreciates the help from the current executive committee of the Society. Finally, the Board, on behalf of the Nepal Geological Society, gratefully acknowledges the financial and technical supports from the consulting firms, agencies, and organizations.

We hope that the readers will find this volume useful and informative. We believe that the contents of the current volume are of great value to our readers. Comments and suggestions for further improvement of the Bulletin are highly welcomed.

Thank you!
–Editorial Board

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NGS NEWS

NEPAL GEOLOGICAL SOCIETY (NGS)

Nepal Geological Society is the professional umbrella of all geologists working in Nepal and outside of Nepal, has over 700 members among which more than 170 scientists are from foreign countries. The Society was established in 1980 with the aim of developing and promoting the research and application of geological sciences to the national development through fostering high professional standard among members; promoting and protecting the professional interests of earth scientist of the country and to play an active role in the protection and conservation of environment through reducing the natural disasters. Nepal Geological Society is also country member of the International Association for Engineering Geology and Environment (IAEG).

Since its establishment, the Society has been working towards the advancement of geosciences in Nepal and is playing a leading role towards building up consensus among the government and private sectors on the role of geosciences on the national development. The Society is organizing the international as well as national level seminars, workshop and frequent talk programs. The Journal of Nepal Geological Society is the only one scientific journal regularly published from Nepal that incorporates research findings focused to the Himalayan Regions in addition to its annual activites, The bulletin of the Society includes the articles that are more focused to the interest of general public.

Scientific Talk Programs, Workshops, and Interactions organized by NGS

S.N.	Date	Title	Speaker	Location	No. of Participants	Collaborating organizations
1	15th October 2015	IDDR Day celebration	Many	Mitra Kunja Hall	90	Nalsing Gad Hydro Project. Ministry of Energy, Nepal, Engineers Without Borders USA, Mitra Kunj
2	19th January 2016	Landslide Deformation Character Inferred from Terrestrial Laser Scanner Data	Arjun Aryal	DMG Auditorium Hall	110	Nepal Geological Society
3	19th January 2016	Aftershock sequence of Gorkha Earthquake 2015	Lok Bijaya Adhikari	DMG Auditorium Hall	110	Nepal Geological Society
4	4th March 2016	Ground response of the Kathmandu Sedimentary Basin during the 2015 Gorkha (Nepal) Earthquake Sequence	Sudhir Rajaure	DMG Auditorium Hall	125	Nepal Geological Society
5	4th March 2016	Repeated catastrophic valley infill following medieval earthquakes in the Nepal Himalaya	Basanta Raj Adhikari	DMG Auditorium Hall	125	Nepal Geological Society

37th AGM and 17th Biennial Function

The 37th Annual General Body Meeting (AGM) and Biennial Function of the Nepal Geological Society (NGS) was held in the Lainchaur Banquet, Lainchaur, Kathmandu on 28th August, 2015 (11th Bhadra, 2072). President of the 16th Executive Committee Dr. Dinesh Pathak chaired the General Body Meeting. The meeting began with the welcome speech by Mr. Dinesh Napit, General Secretary, NGS. Mr. Napit presented the Annual Report to the General Body highlighting the various activities and events the 16th committee carried out in the last one year. Treasurer presented the Financial Report, including the Auditor's Report, for the Fiscal year 2070/071 B.S. Following the presentation of the General Secretary and Treasurer, a lively discussion session was held on various issues to address the question raised by NGS members in connection with the Annual and financial reports. After the discussion both the reports presented by the General Secretary and Treasurer were approved by the AGM. With the recommendation of the Executive Committee, the AGM decided to appoint Mr. Bhoj Raj Ghimire as new auditor for the year 2071/2072. More than 150 NGS members participated and discussed on various issues during the meeting. After 37th AGM, the 17th Biennial Function was started.

NGS NEWS

Chief Guest of this function was Hon'ble Radha Kumari Gyawali, Minister, Ministry of Energy, Government of Nepal. Dr. Dinesh Pathak President, 16th Executive Committee and Dr. Danda Pani Adhikari, newly elected President of the 17th Executive Committee delivered speeches on various issues. Handover of the Society to the 17th Executive Committee took place.

Honorary Fellowship Award of NGS

16th Executive Committee of NGS had proposed the name for honorary fellowship during AGM. The proposed names were recommended by recommendation committee. Nominated members for the Honorary fellowship of the Nepal Geological Society are Professor Harutaka Sakai, Kyoto University, Japan and Mr. Achyuta Nanda Bhandary (Past President of NGS) Nepal. Honorary fellowship award is going to be awarded on the occasion of coming 8th Nepal Geological Congress organized by NGS on November 2016.

IDDR Day-2015 Observed

Nepal Geological Society (NGS) is being a professional organization that is committed to work towards reducing hazard, vulnerability, and disaster in the country. It has been working in disaster inventory, preparedness and advocacy since its establishment (last three decades). United Nation (UN) proclaimed the theme to celebrate disaster day 2015-2016 as: "KNOWLEDGE FOR LIFE". Giving high priority to this theme NGS organized a one day workshop on 15th October, 2015 in collaboration with Nalsing Gad Hydro Project. Ministry of Energy, Nepal, Engineers Without Borders USA, Mitra Kunj, Russian Centre for Science and Culture. The program was inaugurated and addressed by Hon'ble Vice-chairman of National Planning Commission Prof. Dr. Govinda Pokharel. The program was also addressed by the distinguished guests present in the program. There were three thematic presentations, each followed by discussion over the queries of participants. The workshop was divided into two sessions namely Inauguration Session and Technical Session. There were more than 80 participants consisting of researchers, policy makers and representatives of organizations working in the disaster sectors.

NEPAL GEOLOGICAL SOCIETY

37th General Annual Meeting and 17th Biennial Function

Lainchaur Banquet, Lainchaur

11 Bhadra 2072 (August 28, 2015)

37th AGM Program

From	To	Activities
15:00	15:15	Registration
15:15	15:20	Call for executive committee in dais
15:20	15:25	Welcome speech by Dr. Dinesh Pathak, **President**
15:25	15:40	Annual reporting by Mr. Dinesh Kumar Napit, **General Secretary**
15:40	15:50	Financial reporting by Mr. Shiva Banskota, **Treasurer**
15:50	15:55	Reporting of 7th Nepal Geological Congress, Prof. Dr. Vishnu Dangol, **Convener**
15:55	16:00	Reporting of Editorial Board, JNGS, Dr. D. P. Adhiari-**Chief Editor**
16:00	16:05	Report by election committee, Ms. Shova Singh, **Chairperson Election Committee**
16:05	16:20	Presenting name of Honorary member for approval Prof. Dr. S. D. Shrestha, **Co-ordinator of the Honorary member reporting committee**
16:20	16:25	Appointment of auditors for next two years
16:25	16:40	Proposal for eligibility criteria for various positions in EC
16:40	16:45	Miscellaneous
16:45	16:55	Distribution of letter of appreciation
16:55	17:00	Vote of thanks and closing by Sudhir Rajaure, **Vice-President**
17:00	17.30	Tea and Coffee

17th Biennial Function

From	To	Activities
17:30	18:00	Registration for biennial funtion
18:00	18.05	Chairing of session by President-16th EC (call on the dais to 16th EC, Chief Guest, President of the 17th EC, Welcome Speech by Dr. Dinesh Pathak, **President-16th EC**
18:05	18:10	Program inauguration by **Chief Guest**
18:10	18:20	Speech by secretaries Ministry of Irrigation/Industry/Energy
18:20	18:25	Speech by Mr. Bishwa Man Pradhan, **Honorary Member of NGS**
18:25	18:30	"Geology of the Nepal Himalaya"-book release. Brief about book and experience during book writing by author Prof. Dr. Megh Raj Dhital
18:30	18:35	Handing over ceremony to 17th EC and introduction to 17th EC team
18:35	18:45	Speech by Dr. D. P. Adhikari, **President 17th EC**
18:45	18:50	Certificate distribution Honorary member Prof. Dr. M. P. Sharma Financial contributors during organization of NGC VII
18:50	19:00	Speech by Chief Guest Honorable Radha Kumari Gyawali, **Minister, Ministry of Energy, Government of Nepal**
		Vote of thanks and closing by Sudhir Rajaure, Vice-President 16th EC
		Group Photo of 16th EC and 17th EC with Chief Guest followed by Dinner

37TH ANNUAL GENERAL BODY MEETING OF THE NEPAL GEOLOGICAL SOCIETY

28th August 2015 (11th Bhadra 2072)

नेपाल भौगर्भिक समाजको सैँतिसौँ वार्षिक साधारण सभामा सोह्रौँ कार्यकारिणी समितिका अध्यक्ष डा. दिनेश पाठकको मन्तव्य

समाजका सम्मानित सदस्य, पूर्व अध्यक्षज्यू तथा सम्पूर्ण सदस्य साथीहरू,

नेपाल भौगर्भिक समाजको सैँतिसौँ साधारण सभामा यहाँहरू सबैलाई हार्दिक स्वागत गर्न पाउँदा गौरवान्वित महसुस गरिरहेको छु । यहाँहरू सबैको प्रयास, सहयोग र सद्भावका कारण यस समाज पेशागत समाजहरूको बिचमा अग्रणी स्थान बनाउन सफल भएको छ । यहाँहरूले यस सोह्रौँ कार्यकारिणी समितिलाई सुम्पिनु भएको जिम्मेवारीलाई हामीले समाज, भूविज्ञान तथा समाजका सदस्यहरूको हितमा इमान्दारीपूर्वक गरेका कार्यहरूको बारेमा यहाँहरू जानकार नै हुनुहुन्छ । उदाहरणका लागि केहि विषयवस्तुहरू निम्न बमोजिम छन् :

१. समाजको तर्फबाट भूविज्ञानको महत्व तथा भूवैज्ञानिकले दिनसक्ने योगदान लगायत सरकारी संरचनामा गर्नुपर्ने परिवर्तन, भूवैज्ञानिकको लागि पद सिर्जना गर्नुपर्ने आवश्यकता सम्बन्धी लेख, टेलिभिजन, रेडियो अन्तर्वार्ता मार्फत् सम्बन्धित पक्षको ध्यानाकर्षण र प्रत्यक्ष रूपमा भेटघाट गरेर समस्या समाधानको लागि विचार प्रस्तुत ।

२. भौगर्भिक काउन्सिलको स्थापनार्थ अन्तरक्रिया कार्यक्रमहरूको आयोजना गरि आवश्यक आँकडा सङ्कलन गरि प्रशासनिक तथा राजनैतिक वृत्तमा यसको आवश्यकता सम्बन्धी जानकारी प्रवाह गरि उपयुक्त वातावरणको सिर्जना गरिएको ।

३. वैशाख १२, २०७२ को भूकम्प पश्चात भूविज्ञानको आवश्यकता र महत्व, भूविपत् न्यूनीकरणमा भूवैज्ञानिकको भूमिका, हालको अवस्था सम्बन्धमा विभिन्न सरकारी निकायहरूले आयोजना गरेका कार्यक्रममा समाजको धारणा प्रस्तुत, साथै सर्वसाधारणलाई सञ्चार माध्यम मार्फत् यथार्थ जानकारी दिने कार्य गरियो ।

४. अन्य पेशागत समाज, प्राज्ञिक संस्था, सरकारी संस्था तथा अन्तर ाष्ट्रिय गैर सरकारी संस्थासँगको सहकार्य, वैशाख १२ को भूकम्प पश्चात् गृह मन्त्रालय, खानी तथा भूगर्भ विभाग, भूगर्भ विभाग त्रि. वि. तथा ICIMOD सँग संयुक्त रूपमा पहिरो जोखिमको अध्ययनमा अत्यन्त संयोजनकारी भूमिका निर्वाह गरेको बारेमा यहाँहरू सबै जानकार नै हुनुहुन्छ ।

गत ७–९ अप्रिल २०१५ मा यस समाजले आयोजना गरेको सातौँ नेपाल भौगर्भिक कांग्रेस विभिन्न अवरोध तथा उतारचढावका बावजुद यहाँहरूको सक्रिय सहयोगले सफलतापूर्वक सम्पन्न गर्न सम्भव भयो । यसका लागि खानी तथा भूगर्भ विभाग, ICIMOD, राष्ट्रपति चुरे तराई मधेस संरक्षण समिति, भूगर्भ विभाग त्रि. वि., नेपाल विज्ञान तथा प्रविधि प्रज्ञाप्रतिष्ठान, DASE-France, Earth Observatory-Singapore, सिमेन्ट उद्योगहरू तथा Consultancy हरूले उपलब्ध गराएको आर्थिक सहयोगको लागि समाजको तर्फबाट विशेष धन्यवाद व्यक्त गर्दछु । साथै समाजका सदस्यहरूले आ–आफ्नो स्थानबाट आर्थिक सहयोग जुटाउन गर्नु भएको प्रयासको यस समिति उच्च मूल्याङ्कन गर्दछ । यसमा विशेषत: श्री सर्वजीतप्रसाद महतो, श्री जगदिशनाथ श्रेष्ठ, श्री कृष्णप्रसाद काफ्ले, श्री उत्तमबोल श्रेष्ठ, डा. श्री सुरेशदास श्रेष्ठ, श्री सागरकुमार राई, डा. श्री सोमनाथ सापकोटा, श्री रामप्रसाद घिमिरे, श्री लीलानाथ रिमाल, श्री दिलिपकुमार सडौला, श्री राजेन्द्र खनाल, श्री समज्ज्वलरत्न बज्राचार्य, श्री नीर शाक्यको भूमिका उल्लेख्य रहेको छ । उहाँहरू सबैलाई यस कार्यकारी समितिको तर्फबाट हार्दिक धन्यवाद व्यक्त गर्न चाहन्छु । यस कार्यक्रमलाई सफल पार्न प्रा. डा. विष्णु डंगोलले Convener को रूपमा निर्वाह गर्नु भएको महत्वपूर्ण भूमिकाको लागि कृतज्ञता व्यक्त गर्दछु र स्वयमसेवकका रूपमा विभिन्न कार्यहरूमा सहयोग गर्नुहुने समाजका सदस्यहरू विशेष धन्यवादको पात्र हुनुहुन्छ ।

नेपाल भौगर्भिक समाजले प्रत्येक वर्ष दुई जना विज्ञहरूलाई प्रदान गर्न सक्ने सम्मानित सदस्यताको लागि उपयुक्त व्यक्तित्वको चयनको लागि सहयोग गर्न यस समाजका बरिस्ठ सदस्य प्रा. ड़ा. श्री सुरेशदास श्रेष्ठज्यूको संयोजकत्वमा गठन गरिएको सिफारिस समितिले आवश्यक गृहकार्य गरी सिफारिस गरेको नामावलीलाई कार्यकारी समितिले सहमति प्रदान गरि यस साधारण सभामा निर्णयार्थ राख्न गईरहेको छ, हामीलाई आशा छ भूविज्ञान, नेपाल हिमालय तथा नेपाल भौगर्भिक समाजका लागि महत्वपूर्ण योगदान दिनुहुने वहाँहरूको नामलाई यस सभाले सर्वसम्मतिबाट स्वीकृत गरि सम्मानित सदस्यहरूको सम्मानपूर्वक मनोनयन गर्ने विगतको हाम्रो गौरवमय परम्परालाई निरन्तरता दिनेछ । यस सम्मानको लागि थुप्रै व्यक्तित्वहरू योग्य हुँदाहुँदै पनि हामीले एकवर्षमा दुई जनालाई मात्र मनोनयन गर्न सक्ने अधिकार समाजको विधानले निर्धारित गरेको छ । आउँदा वर्षहरूमा समाजले यो प्रक्रियालाई निरन्तरता दिँदै क्रमिक रूपमा वहाँहरूको योगदानलाई सम्मान गर्नेछ भन्ने विश्वास व्यक्त गर्दछु ।

परिवर्तित स्थितिमा कार्यकारी समितिको विभिन्न पदमा उम्मेद्वारी दिनको लागि उम्मेदवारको योग्यता छलफलको लागि यहाँ प्रस्तुत गरेका छौँ :

१. खानी तथा भूगर्भ विभागले निरन्तर रूपमा समाजको कार्यालय सञ्चालनको लागि र अन्य सहयोग गरि आएकोमा समाज कृतज्ञ छ र भविष्यमा पनि यस प्रकारको सहयोगको अपेक्षा गर्दछ ।

२. सोह्रौं कार्यकारी समितिको विभिन्न समितिहरूमा बसी सहयोग गर्नुहुने तथा समाजका बिभिन्न कार्यक्रमहरूलाई सफल बनाउन प्रत्यक्ष तथा अप्रत्यक्ष रूपमा सहयोग गर्नुहुने सबै सदस्य महानुभावहरू प्रति यस कार्यकारी समिति हार्दिक आभार व्यक्त गर्दछ ।

३. समाजको एक महत्वपूर्ण कार्यको रूपमा लिइएको जर्नल प्रकाशनमा योगदान दिनुहुने डा. दण्डपाणि अधिकारी लगायत एडिटोरियल बोर्डका साथीहरूलाई विशेष धन्यवाद छ ।

अन्तमा सोह्रौं कार्यकारी समितिका सबै साथीहरूलाई समाजका हरेक कार्यमा सक्रियतापूर्वक क्रियाशील हुनुभएकोमा मेरो व्यक्तिगत तर्फबाट धन्यवाद व्यक्त गर्दछु ।

सम्पूर्ण सहभागी सदस्य महानुभावहरूलाई यस साधारण सभामा फेरि पनि स्वागत गर्दै सक्रिय सहभागिताको लागि अनुरोध गर्दछु ।

धन्यवाद !

२०७२ भाद्र ११

नेपाल भौगर्भिक समाजको सोह्रौँ कार्यकारिणी समितिका महासचिव श्री दिनेशकुमार नापितको मन्तव्य

यस समारोहका सभापति एवं समाजका अध्यक्षज्यू,
समाजका पूर्व अध्यक्षज्यूहरू,
कार्यकारिणी समितिका सदस्यज्यूहरू,
समाजका उपस्थित सदस्यज्यूहरू,

नेपाल भौगर्भिक समाजको ३७औँ यस गरिमामय साधारण सभामा १६ औँ कार्यकारिणीले विगत एक वर्ष कार्य अवधिमा भए गरेका क्रियाकलापहरू प्रस्तुत गर्दै छु। समाजको गत वर्षको क्रियाकलाप लगायत अन्य विषयवस्तु समावेस गरेर नेपाल भौगर्भिक समाजको बुलेटिन पूर्णाङ्क ३१ प्रकाशित भैसकेको र सो यहाँहरूले प्राप्त गरिसक्नु भएको छ। यहाँ म मूख्य क्रियाकलापहरूलाई सङ्क्षेपमा प्रस्तुत गर्दछु।

१. गत वर्ष यस १६ औँ कार्यकारिणी समितिले 'Older Persons and Disaster-Resilence is for Life' संयुक्त राष्ट्र सङ्घको नारा रहेको IDDR DAY-2014 मनाएको थियो र यस सन्दर्भमा 28 October 2014 (२१ कार्तिक २०७१) मा रुसी साँस्कृतिक केन्द्र तथा (Himalayan Conservation Group, HCG) सँगको संयुक्त आयोजनामा एक दिने कार्यशाला गोष्ठी पनि आयोजना गरिएको थियो। सो कार्यक्रमको प्रमुख अतिथि माननीय श्री वामदेव गौतम रहनु भएको थियो।

२. २१ कार्तिक २०७१ मा Hydrogeological Association सँगको संयुक्त आयोजनामा 'नेपालमा सरकारी, अर्धसरकारी तथा नीजि संस्थाहरूमा भूवैज्ञानिकहरूको पेशागत अवसर, समस्या र चुनौती' विषयक अन्तर्क्रिया कार्यक्रम सम्पन्न भएको थियो। उक्त कार्यक्रमको प्रमुख अतिथि माननीय सिंचाई मन्त्री श्री एन. पी. साउद रहनु भएको थियो।

३. १० श्रावण २०७२ मा त्रि. वि. विज्ञान तथा प्रविधि अध्ययन संस्थान, डीन कार्यालयलाई Admission Eligibility to MSc Engineering Geology सम्बन्धमा समाजको ध्यानाकर्षण भएको जनाउँदै भूगर्भशास्त्र विषयमा स्नातक उपाधि प्राप्त उम्मेदवारलाई प्रवेशको प्रावधान राख्न अनुरोध गर्दै पत्राचार गरिएको थियो।

४. निजामति सेवा ऐन २०४९ लाई संसोधन गर्न बनेको विधेयक २०७१ ले नेपाल सरकारको प्राविधिक सेवामा कार्यरत कर्मचारी प्रति पर्न जाने दूरगामी तथा नकरात्मक प्रभावप्रति समाजको गम्भीर ध्यानाकर्षण भएको जनाउँदै प्रेस विज्ञप्ति जारी गरिएको थियो।

५. १२ मे २०१५ मा समाजको अध्यक्षको नेत्रृत्वमा पूर्व प्रधानमन्त्री बाबुराम भट्टराईसँग भेट गरि जियोलोजिकल काउन्सिल लगायतका विषयमा छलफल गरेको थियो।

६. नेपालको संविधान २०७२ को प्रारम्भिक मस्यौदामा भू–विज्ञान सम्बन्धी सरोकार राख्ने विषयमा नेपाल भौगर्भिक समाजका सदस्यहरूबाट भू–विज्ञानको महत्व, उपयोगिता, विकास तथा भू–वैज्ञानिकको हक अधिकार सँग सम्बन्धित राय सङ्कलन गरि सम्बन्धित निकायमा पेस गरिएको थियो।

७. अप्रिल ७ देखि ९, २०१५ मा याक एन्ड यति होटल, दरबार मार्गमा तीन दिनको 7th Nepal Geological Congress सम्पन्न भएको थियो। सो कार्यक्रममा २२ देशका २०० जना भूगर्भविद्हरूको उपस्थितिमा ११० वटा कार्यपत्र प्रस्तुत गरिएको थियो। उक्त कार्यक्रममा समाजका पूर्व अध्यक्ष तथा नास्टका प्राज्ञ प्रा. डा. श्री विशालनाथ उप्रेती तथा समाजका आजीवन सदस्य Prof. George Mascle, France लाई समाजद्वारा सम्मानित सदस्यता प्रदान गरिएको थियो।

८. आगामी वर्ष समाजद्वारा सम्मानित सदस्यता प्रदान गर्नको लागि सदस्यहरूको छनौट गर्नको लागि समाजका आजीवन सदस्य डा. सुरेशदास श्रेष्ठ संयोजक तथा श्री नीर शाक्य एवं श्री लीलानाथ रिमाल सदस्य रहेको समितिलाई जिम्मेवारी प्रदान गरिएको थियो।

९. त्रिभुवन विश्वविद्यालय, भूगर्भ शास्त्र केन्द्रीय विभागको सिफारिसमा श्री मित्र राई छात्रवृत्ति पुरस्कार श्री प्रकाश पोखरेललाई प्रदान गर्ने निर्णय गरिएको छ।

१०. सरकारी एवं गैर सरकारी संस्थाहरूद्वारा आमन्त्रित कार्यक्रममा कार्यकारिणी समितिका सदस्य तथा समाजका सदस्यहरूलाई प्रतिनिधित्व गराई भाग लिने निर्णय गरिएको छ।

अन्त्यमा, समाजको कार्यमा निरन्तर सहयोग र साथ दिनु भएकोमा सम्पूर्ण सदस्यहरू लगायत सम्पूर्ण निकायहरूप्रति आभार एवं धन्यवाद व्यक्त गर्दै आगामी दिनहरूमा पनि सहयोगको अपेक्षा राखेको छु। साथै नवनिर्वाचित १७ औँ कार्यकारिणी समितिका सम्पूर्ण सदस्यज्यूहरूलाई कार्यकालको सफलताको शुभकामना व्यक्त गर्दै यो वार्षिक प्रतिवेदनको प्रस्तुति यहि टुङ्ग्याउने अनुमति चाहन्छु।

धन्यवाद !

नेपाल भौगर्भिक समाजको सोह्रौँ कार्यकारिणी समितिका कोषाध्यक्ष श्री शिवकुमार बास्कोटाको मन्तव्य

यस सभाका सभापतिज्यू
समाजका आदरणीय पूर्व अध्यक्षज्यूहरू
सोह्रौँ कार्यकारिणी समितिका साथीहरू
साथै समाजका उपस्थित साथीहरू

आज म यहाँ सोह्रौँ कार्यकारिणी समितिले गत आर्थिक वर्ष २०७१/७२ को एक वर्षको कार्यकालमा गरेको आर्थिक आयव्ययको विवरणलाई अधिकार प्राप्त लेखा परीक्षकबाट परीक्षण समेत गराई यस समाजको सैँतिसौँ साधारण सभामा पेश गर्न लागेको छु।

१. गत आर्थिक वर्षको २०७०/७१ साल असार मसान्तसम्म बैंकमा रहेकोमौज्दात ने. रू. ५०,८३,६०१.२८
(आ.व. २०६९/७० मा ५३,७७,८१०.८४)
जस अन्तर्गत नविल बैंक (चल्ती) मा ने. रू ४,३१,४४६.०६
(आ.व. २०६९/७० मा ने. रू. ९,९३,१२७.८९)
नविल बैंक (डलर खाता) मा अमेरिकी डलर ४४,७३१.९२ बराबर ने. रू. ४२,४९,५३२.४०
(आ.व. २०६९/७० मा ने. रू. ४२,३९,०८२.४०)

२. यस आर्थिक वर्ष २०७१/७२ साल असार मसान्तसम्म समाजसँग रहेकोबैंक मौज्दात ने. रू. ५९,६९,८३१.०३ मात्र।
बैंक मौज्दात अन्तर्गत :
नबिल बैंक (चल्ती) मा ने. रू. २२,५०,५६०.८५
नबिल बैंक (डलर खाता) मा ने. रू. ३२,३६,३०७.०० (अमेरिकी डलर ३२३६३.०७) (१ अमेरिकी डलर बराबर ने. रू. १०० को सटही दर अनुसार)
नेपाल बैंक लिमिटेड (चल्ती) मा ने. रू. ९९४९.६८
नेपाल बैंक लिमिटेड (वचत) मा ने. रू. ६००७५.४४
कृषि विकास बैंक लिमिटेड (चल्ती) मा ने. रू. ७९१५३.०७
राष्ट्रिय वाणिज्य बैंक (चल्ती) मा ने. रू. २८७८४.९९
राष्ट्रिय वाणिज्य बैंक (मुद्दती) मा ने. रू. २४०००.००

३. यस आर्थिक वर्षमा :
जम्मा आम्दानी ने. रू. ४१,६०,२४२.५२
जम्मा खर्च ने. रू. ३०,५०,२८३.२२
खर्च र आम्दानीको विस्तृत विवरण इन्कम एन्ड एक्स्पेन्डिचर अकाउण्टमा दिइएको छ।

४. यसरी हेर्दा आ.व. २०७०/७१ खर्च भन्दा आम्दानी बढी देखिएको र समाज आर्थिक दृष्टिले सन्तोषजनक अवस्थामा रहेको देखिन्छ। अन्तमा आर्थिक प्रतिवेदनको विवरण सम्बन्धमा कुनै प्रतिक्रिया र सुझावहरू भए सो को अपेक्षा राख्दै मेरो प्रस्तुति अन्त गर्न चाहन्छु।
धन्यवाद !
११.०५.२०७२

Speech of Prof. Dr. Vishnu Dongol
Convener, 7th Nepal Geological Congress at 37th AGM of NGS

Mr. Chairman
Honorary Members of the Nepal Geological Society
Past Presidents of the Society
Executives of the Society
Dear Fellow Members
Ladies and Gentlemen

First of all I would like to thank for giving me an opportunity to put forward a few words regarding the past Seventh Nepal Geological Congress (NGC-VII) – A truly International Geo-scientific Event organized in Kathmandu from 7th to 9th April, 2015. The Nepal Geological Society (NGS) had formed a 59-member Organizing Committee and 19-member Advisory Committee, which included a number of high ranking officials of Nepal and eminent scientists from Nepal and abroad.

The main theme of the Congress was "Geosciences in Sustainable Development: Challenges and Opportunities". We've received 166 abstracts from 23 countries covering all 13 sub-themes of the Congress, among which 151 are published in the Journal of Nepal Geological Society as Abstract Volume. The Congress was participated by nearly 200 people, among which a quarter was from abroad. I sincerely believe that the Seventh Nepal Geological Congress (NGC-VII) facilitated to scientists of 23 countries (Armenia, Australia, Bangladesh, Bhutan, China, France, Germany, India, Indonesia, Iran, Italy, Japan, Korea, Morocco, Nepal, Philippines, Pakistan, Poland, Russia, Singapore, Thailand, United Kingdom and USA) from all the continents of the globe for closer interaction between them belonging to different interrelated geo-scientific disciplines.

Though a general strike in Nepal was called by opposition parties during the period of the NGC-VII, the Congress was successfully organized in Hotel Yak and Yeti, Kathmandu. We were very thankful to Prof. Dr. Jibraj Pokharel, Vice Chancellor of Nepal Academy of Science and Technology (NAST), who took a great trouble to reach the venue during the troubled day (7th April) and to encourage us and also for spending his valuable time to inaugurate this scientific Congress. Similarly, we got the encouragement from all the distinguished guests and participants who had reached to the venue walking a long distance from different parts of the Kathmandu Valley.

There were 17 Oral Sessions including 3 keynote and 1 special paper sessions, and 2 Poster Sessions. Altogether 109 oral and 21 poster presentations on 12 themes were done. The presenters included not only seasoned and highly experienced scholars, but also by fresh students and Ph.D. scholars. The floor also very actively participated in the discussion with genuine questions, decent comments and superb suggestions for future researches.

Another important feature of the Congress was best presenters award for students and Ph.D. scholars. For this I would like to thank all of the participants to select best presenters and especially to Dr. Ranjan Kumar Dahal and his team.

Continuous and large contributions to researches and publications on Geology of Himalaya by Prof. Dr. Georges Mascle (France) and Prof. Dr. Bishal Nath Upreti (Nepal) were greatly recognized by the Nepal Geological Society. They were conferred honorary fellows of the Society. The certificates and tokens of appreciations were handed over to them by Prof. Dr. Jibraj Pokharel, Vice-Chancellor of NAST during the inguration session of the NGC-VII.

A post-congress excursion was also carried out along the Kathmandu-Kodari route. Seven persons from Russia, USA, Singapore and Morocco had taken part in one-day excursion. Thanks go to Mr. Lila Nath Rimal and his team for preparation of excursion material and successful conduction of the excursion.

I express gratitude to all who have helped the NGC-VII in different ways: Management of Hotel Yak and Yeti and Hotel Shakti; NGS Executive Committee and the members of the Organizing and Advisory committees. We are very grateful to national and international institutions who have provided generous financial and other necessary supports.
Lastly, I appreciate your kind attention. Thank you.

सत्रौँ कार्यकारिणी समितिका लागि निर्वाचन समितिकी संयोजक शोभा सिंहको मन्तव्य

श्रीमान् कार्यकारिणी समितिका अध्यक्षज्यू,
पूर्व अध्यक्षज्यूहरू,
नेपाल भौगर्भिक समाजका सदस्यज्यूहरू,

म यस नेपाल भौगर्भिक समाजको सत्रौँ कार्यकारिणी समितिका लागि भर्खरै सम्पन्न भएको निर्वाचनको विवरण प्रस्तुत गर्दै छु ।

नेपाल भौगर्भिक समाजको सोह्रौँ कार्यकारिणी समितिबाट गठित निर्वाचन समितिमा म लगायत सञ्जिता मिश्र र गौतम खनाल सदस्य रहेका थियौँ ।

यसपटकको निर्वाचनमा अध्यक्ष पदमा डा. दण्डपाणि अधिकारी, उप महासचिव पदमा डा. अशोक सिग्देल र कोषाध्यक्ष पदमा मोनिका झा निर्विरोध निर्वाचित हुनु भएको थियो ।

उपाध्यक्ष, महासचिव र तीन वटा सदस्य पदका लागि २०७२ भाद्र ४ गते, शुक्रबारका दिन खानी तथा भूगर्भ विभागको अडोटोरियम हलमा निर्वाचन सम्पन्न गरिएको थियो ।

निर्वाचनमा जम्मा २६५ मत प्राप्त भएका थिए । हुलाकबाट २०, अग्रिम मतदानबाट ९४ र प्रत्यक्ष मतदानबाट १५१ मतहरू प्राप्त भएका थिए । प्राप्त मतमध्ये १ मत बदर भएको थियो ।

उपाध्यक्ष पदका उम्मेदवार श्री मुकुन्दराज पौडेलले २२७ मत प्राप्त गरेर विजयी हुनु भएको थियो भने उपाध्यक्ष पदका अर्का उम्मेदवार श्री कौशलकुमार झाले ३५ मत प्राप्त गर्नु भएको थियो ।

महासचिव पदका उम्मेदवार डा. प्रेमबहादुर थापाले १९३ मत प्राप्त गरेर विजयी हुनु भएको थियो भने महासचिव पदका अर्का उम्मेदवार श्री कुमार खड्काले ७८ मत प्राप्त गर्नुभएको थियो ।

सदस्य पदका लागि उम्मेदवार कविता कार्कीले १८४ मत, दिलेन्द्र राज पाठकले १५६ मत र हरि घिमिरेले १५३ मत प्राप्त गरी विजयी हुनु भएको थियो । सदस्य पदका लागि उम्मेदवारहरू रोशनराज भट्टराईले १५२ मत र लक्ष्मण सुवेदीले ११६ मत प्राप्त गर्नुभएको थियो ।

विजयी उम्मेदवारहरूलाई निर्वाचन समितिका तर्फबाट हार्दिक बधाई छ । निर्वाचन समितिका सदस्य सञ्जिता मिश्र र गौतम खनाललाई निर्वाचन सफलतापूर्वक सञ्चालन गरिदिनु भएकोमा धन्यवाद छ ।

त्यसै गरी निर्वाचनको दिनमा सहयोग गरिदिनु हुने सबै साथीभाइहरूलाई निर्वाचन समितिको तर्फबाट हार्दिक धन्यवाद दिन चाहन्छु ।

११ भाद्र २०७२

नेपाल भौगर्भिक समाजको सैँतिसौँ साभारण सभामा समाजका उपाध्यक्ष श्री सुधीर रजौरेको धन्यवाद ज्ञापन

यस समारोहका सभापतिज्यू,
यस सभाका प्रमुख अतिथिज्यू,
यस समाजका सोह्रौँ कार्यकारिणी समितिका अध्यक्षज्यू,
समाजका सम्मानित सदस्य, पूर्व अध्यक्षज्यूहरू,
तथा यस सैँतिसौँ साधारण सभामा उपस्थित समाजका साधारण सदस्यहरू,

आज हामीले सोह्रौँ कार्यकारिणी समितिको दुई वर्षे कार्यकाल पुरा गरेका छौँ । यस समाजको सोह्रौँ कार्यकारिणी समितिले गत दुईवर्षमा गरेका कार्यहरूको बारेमा सम्पूर्ण सदस्यहरू अवगत नै हुनुहुन्छ ।

आज शुक्रबारका दिन आफ्ना सम्पूर्ण व्यस्तताका माझ यस साधारण सभामा उपस्थित हुनु भएका सम्पूर्ण सदस्यहरूमा यस समाज, कार्यकारिणी समिति र म स्वयम्का तर्फबाट हार्दिक धन्यवाद दिन चाहन्छु । यसै गरी यस सभामा समाजका सम्मानित सदस्यज्यूहरू, पूर्व सभापतिज्यूहरू उपस्थित भएर यस समाजको शोभा बढाउँदै आफ्ना अमूल्य सुझाव प्रदान गर्नु भएकोमा हार्दिक आभार प्रकट गर्दछु ।

यस सोह्रौँ कार्यकारिणी समितिले आयोजना गरेका हरेक कार्यक्रममा सहभागी भएर प्रत्यक्ष तथा अप्रत्यक्ष सहयोग गर्नुहुने संघसंस्था तथा महानुभावहरूमा यस समाजको सोह्रौँ कार्यकारिणी समिति तथा म स्वयम्का तर्फबाट कृतज्ञता व्यक्त गर्दछु ।

अन्त्यमा, आजको यस कार्यक्रम सफल पार्न अग्रपंक्ति तथा नेपथ्यमा रहेर आफ्नो अमूल्य समय दिनुहुने सबै सहयोगी हातहरूप्रति म धन्यवाद व्यक्त गर्दछु । यसका साथै अध्यक्षको अनुमतिले साधारण सभाको कार्यक्रम समापन भएको घोषणा गर्दछु ।

धन्यवाद !
२०७२.०५.११

नेपाल भौगर्भिक समाजको सत्रौँ द्विवार्षिक कार्यक्रममा समाजका अध्यक्ष डा. दिनेश पाठकको मन्तव्य

यस समारोहका प्रमुख आतिथि माननीय उर्जा मन्त्री श्री राधाकुमारी ज्ञवालीज्यू,
मञ्चमा आसन्न नेपाल सरकारका सचिवज्यू,
नेपाल भौगर्भिक समाजका सम्मानित सदस्यज्यू,
विभिन्न पेसागत समाजका प्रतिनिधिहरू,
आमन्त्रित महानुभावहरू,
समाजका सदस्य साथीहरू,

नेपाल भौगर्भिक समाजको सत्रौँ द्विवार्षिक कार्यक्रममा हाम्रो आग्रहलाई स्वीकार गरेर आ–आफ्ना व्यस्तताको माझमा यहाँ उपस्थित भईदिनु भएकोमा सर्वप्रथमत: समाजको तर्फबाट यहाँहरू प्रति हार्दिक आभार व्यक्त गर्दै स्वागत अभिवादन गर्दछु । भूगर्भविद्हरूको भौगर्भिक ज्ञानलाई प्राज्ञिक तथा विकासमूलक प्रयोजनको लागि उचित अवसर सिर्जना गर्ने कार्यमा नेपाल भौगर्भिक समाज स्थापनाकाल (वि. सं. २०३७) देखि नै क्रियाशील रहदै आएको व्यहोरा यहाँहरूलाई जानकारी गराउन चाहन्छु ।

नेपाल भौगर्भिक समाजका सदस्य हामी भूवैज्ञानिकहरू प्राज्ञिक, सरकारी, अर्धसरकारी, गैरसरकारी तथा निजी क्षेत्रमा कार्यरत रही आआफ्नो ज्ञान र दक्षता अनुसारको विषयगत योगदान दिइरहेका छौँ । यसै सिलसिलामा हामी कार्यरत क्षेत्रहरूका अवसर र चुनौती पनि क्षेत्रगत रूपमा भिन्न छन् ।

नेपाल सरकारले देश विकासको कार्यमा भूगर्भविद्को आवश्यकतालाई राम्रै सँग महसुस गरिसकेको भन्ने हाम्रो बुझाई छ । उर्जा र विशेष गरि जलविद्युतको क्षेत्रमा भूवैज्ञानिकको अपरिहार्य र महत्वपूर्ण भूमिकालाई नेपाल सरकारले मनन गरि भूगर्भविद्लाई महत्वपूर्ण जिम्मेवारी दिएकोमा नेपाल सरकारप्रति आभार व्यक्त गर्दछौँ र आगामी दिनमा भूगर्भविद्को भूमिकालाई अझै महत्व दिइनेछ भन्ने हामीले आशा गरेका छौँ ।

यस विधालाई विकास निर्माण तथा भूविपत् जोखिम न्यूनीकरण लगायतका कार्यहरूमा उपयोग गर्नको लागि आवश्यक व्यवस्था गर्न ढिलाई गर्न नहुने भएको छ । यस सम्बन्धमा यस समाज निम्न विषयमा सरकारको ध्यानाकर्षण गराउन चाहन्छु ।

१. पूर्वाधार विकाससँग सम्बन्धित सबै सरकारी निकाय (सडक विभाग, डोलिडार, खानेपानी विभाग र संस्थान लगायत) मा भूगर्भविद्को उल्लेख्य व्यवस्था र उचित जिम्मेवारीको आवश्यकता ।
२. स्थानीय निकायहरूमा (कमसेकम प्रत्येक जिल्ला विकास समितिमा एकजना) भूगर्भविद्को व्यवस्था गर्नु पर्ने ।
३. भूगर्भ विज्ञान सम्बन्धी अध्ययन अनुसन्धानलाई राज्य स्तरबाट नै उच्च प्राथमिकता दिनु आवश्यक छ । यसै सम्बन्धमा त्रिभुवन विश्वविद्यालयमा भूविपत् अनुसन्धान केन्द्र (Geo-Disaster Research Center) लाई राज्यको तर्फबाट भूविपत् अध्ययन अनुसन्धानको लागि एउटा जिम्मेवार निकायको रूपमा विकास गरि अनुसन्धानको निचोडलाई सरकारको सक्रिय समन्वयमा आवश्यक संरचना निर्माण गर्ने लगायतका काम गर्ने ।
४. हाल विद्यमान नेपाल इन्जिनियरिङ्ग काउन्सिलले भूगर्भविज्ञानलाई समेट्न नसकेको अवस्थामा विभिन्न विधाहरूका भूवैज्ञानिकहरूको पेशागत अधिकार सुनिश्चित गरि उनीहरूलाई बढी जिम्मेवार बनाउनका लागि भौगर्भिक काउन्सिल (Geological Council) स्थापना गर्न ढिलाई भैसकेको छ । यस कार्यका लागि सरकारी सहयोगको अपेक्षा गरिएको छ ।

उपरोक्त कार्यमा नेपाल भौगर्भिक समाज एक पेशागत संस्थाको हैसियतमा नेपाल सरकारसँग राष्ट्रिय चासोको विषयमा आवश्यक सहकार्य गर्नको लागि सदैव तत्पर भएको व्यहोरा विनम्रतापूर्वक अनुरोध गर्दछु ।

माननीय उर्जा मन्त्रीज्यूको उपस्थितिले हामीलाई थप उर्जा प्रदान गरेको छ । हामी आशा एवं विश्वास गर्दछौ कि यस क्षेत्रमा भूविज्ञान सम्बन्धी विद्यमान समस्याको समाधानार्थ सकारात्मक भई निजहरूको उच्च मनोबल कायम गरि भूविज्ञानलाई देश विकासको कार्यमा अझै प्रभावकारी रूपमा उपयोग गर्ने वातावरण सिर्जना गर्ने कार्यमा सरकारी स्तरमा आवश्यक कदम चालिनेछ ।

फेरि पनि यहाँहरू सबैलाई यस कार्यक्रममा न्यानो स्वागत अभिवादन गर्दै आफ्नो मन्तव्य यहिँ अन्त गर्ने अनुमति चाहन्छु ।

धन्यवाद !

नेपाल भौगर्भिक समाजको १७ औं द्विवार्षिक कार्यक्रममा समाजका नवनिर्वाचित अध्यक्ष डा. दण्डपाणि अधिकारीको मन्तव्य

आजको यस १७ औं द्विवार्षिकी कार्यक्रमका प्रमुख अतिथि माननीय उर्जा मन्त्री श्री राधाकुमारी ज्ञवालीज्यू,
नेपाल सरकारका उच्च पदस्थ कर्मचारीज्यूहरू,
अन्य संघ-संस्थाका प्रमुख तथा प्रतिनिधिज्यूहरू,
नेपाल भौगर्भिक समाजका सम्मानित सदस्यज्यूहरू,
नेपाल भौगर्भिक समाजका पूर्व अध्यक्षज्यूहरू,
नेपाल भौगर्भिक समाजका १६ औं तथा नवनिर्वाचित १७ औं कार्यसमितिका पदाधिकारी तथा सदस्यज्यूहरू,
समाजका सम्पूर्ण सदस्यज्यूहरू,
पत्रकार तथा मिडियाबाट आउनु भएका मित्रहरू र
महिला तथा सज्जनवृन्द ।

नेपाल भौगर्भिक समाजको आजको यस १७ औं द्विवार्षिकी कार्यक्रममा उपस्थित सम्पूर्ण महानुभावहरूमा सन्ध्याकालिन अभिवादन सहित यस गरिमामय सभामा मेरा केहि भनाईहरू राख्न चाहन्छु । 'भू-विज्ञानको प्रवर्द्धन मार्फत् समुन्नत नेपालको निर्माणमा टेवा पुऱ्याउने' उदेश्यले वि. सं. २०३७ साल वैशाख २ गते नेपालका भू-गर्भशास्त्री तथा खानी इन्जिनियरहरूद्वारा स्थापित नेपाल भौगर्भिक समाज (ने.भौ.स.) ले ३५ वर्ष पार गरेको यस अवधिमा १६ वटा कार्यसमितिले सेवा गरि सकेका छन् । ने.भौ.स.को हालको प्रत्येक २ वर्षमा हुने नयाँ कार्यसमितिको निर्वाचन विधि अनुसार २०७२ साल भाद्र ४ गते सन्पन्न निर्वाचन मार्फत १७ औं कार्यसमितीको अध्यक्ष पदमा मलाई निर्विरोध निर्वाचित गर्नु भएकोमा सर्वप्रथम ने.भौ.स.का सम्पूर्ण सदस्यज्यूहरूमा हार्दिक आभार व्यक्त गर्न चाहन्छु । यस्तै, उपमहासचिव र कोषाध्यक्ष पनि निर्विरोध निर्वाचित हुनुभएको छ । उपाध्यक्ष, महासचिव र तीन जना सदस्यहरू मतदान प्रक्रियाबाट निर्वाचित भएर आउनुभएको छ । निर्वाचित सम्पूर्ण साथीहरूलाइ वधाई दिन चाहन्छु । जो-जुन संस्थाबाट निर्वाचित भएर आएको भएता पनि सबै ने.भौ.स.का सदस्य हुन् र यसै संस्थाको लागि काम गर्ने हो । अर्को निर्वाचनमा अन्य संस्थाका साथीहरुले नेतृत्व गर्ने अवसर प्राप्त गर्नु हुने छ जुन कुरा सदस्यज्यूहरू सबैले जाने-बुझेकै कुरा हो । मनोनित गर्नु पर्ने तीन जना सदस्यहरू छुट्न गएका संस्थाहरूका, सक्रिय रूपमा काम गर्न ईच्छुक सदस्यहरू मध्येबाट छनोट गरिने छ ।

यस समाजमा हाल करिब ७४० सदस्यहरू छन् । त्यस मध्ये नेपालमा कार्यरत नेपाल भौगर्भिक समाजका सदस्यहरू (भूगर्भशास्त्री, खानी इन्जिनियर र जियोटेक्निकल इन्जिनियर) सरकारी तथा अन्य निकायहरूमा अध्यापन तथा अनुसन्धान, भौगर्भिक नक्साङ्कन, धातु-अधातुको खानी अन्वेषण, पेट्रोलियम अन्वेषण, भूकम्प मापन तथा अनुसन्धान, सिंचाई (भूमिगत जल सहित), खानेपानी आयोजना, जलविद्युत आयोजना, मोटर बाटोको रेखाङ्कन तथा सडक निर्माण, पहिरो तथा अन्य भौगर्भिक प्रकोपको अध्ययन-अनुसन्धान तथा नियन्त्रण, पूर्वाधार तथा अन्य विकास निर्माणको काम जस्ता क्षेत्रमा संलग्न छन् । तर, सिमित श्रोत-साधन र अपर्याप्त प्रविधि तथा विकास-निर्माणको कार्यमा नेपाल सरकारले भू-वैज्ञानिकहरुको यथोचित संलग्नता गराउन नसकेको हुँदा देश आर्थिक रूपमा अगाडि बढ्न अत्यन्त असहज भएको अवस्था छ । संसारमा यस्तो कुनै देश छैन जसले यी क्षेत्रको विकास बिना देश विकास गरेको होस् । माननीय मन्त्रीज्यू तथा अन्य आमन्त्रित अतिथिज्यूहरूलाई यो पनि जानकारी गराउन चाहन्छु, यस समारोहमा यस्ता व्यक्तित्वहरुको उपस्थिति छ जसको भौगर्भिक ज्ञान प्रयोग गर्न सके नेपालको आर्थिक विकासमा ठूलो टेवा पुग्नुको साथै भू-गर्भजन्य विपत्तिमा ठूलो न्यूनीकरण हुने थियो, धन्-जन्को ठूलो क्षति हुनबाट नेपाल बच्ने थियो । दुर्भाग्यवश त्यसो हुन सकेको छैन । यस कार्यक्रमको प्रमुख अतिथि, माननीय उर्जा मन्त्रीज्यू मार्फत् हाम्रा यी आवाज सम्बन्धित ठाउँमा पुऱ्याई दिनु हुन अनुरोध गर्दछु ।

भूकम्प भू-गर्भशास्त्रको अर्को महत्वपूर्ण विधा हो, जसको महत्व २०७२ सालको गोरखा भूकम्पले थप बुझाई दिएको छ । त्यसको साथसाथ भूकम्पको हाल सम्मको ज्ञानलाइ लिएर भूगर्भशास्त्री/भूकम्पशास्त्रीहरुलाई थप चुनौती थपिदिएको पनि छ यो भूकम्पले । यसले अध्ययन-अनुसन्धानलाई राज्यले उच्च प्राथमिकता दिनु पर्ने आवश्यकता देखाई दिएको पनि छ । २०७२ को गोरखा भूकम्प पश्चात प्रभावित क्षेत्रको पूनर्निमाणको लागि गठित् 'राष्ट्रिय पूनर्निमाण प्राधिकरण' को निर्देशक समितिको विज्ञ सदस्यको रूपमा नेपाल सरकारले ने.भौ.स.का आजीवन सदस्य प्रा. डा. तारानिधी भट्टराईलाई मनोनयन गरि भू-गर्भशास्त्रको सम्मान गरेको महशुस गरिएको छ । प्रा. भट्टराईले पूननिर्माणको कार्यमा ने.भौ.स.को प्रतिनिधिको रूपमा महत्वपूर्ण भूमिका निर्वाह गर्नु हुनेछ भन्ने यस समाजले आशा गरेको छ ।

हाम्रा अग्रजहरू जसले यस समाजको स्थापना गरि हुर्काइ, बढाई वर्तमान अवस्थासम्म ल्याई हामीलाई यस विधाको महत्व बोध गराई ने.भौ.स.लाई सबल बनाउन प्रेरणा दिनु भयो, वहाँहरू प्रति कृतज्ञता व्यक्त गर्न चाहन्छु । यस समाजले प्रकाशन गर्ने **'जर्नल अफ नेपाल जियोलोजिकल सोसाईटी'** नेपालको उत्कृष्ट वैज्ञानिक प्रकाशन ठहरिन्छ । यसमा प्रकाशित अनुसन्धानात्मक कृतिहरूले भू-गर्भशास्त्रको विभिन्न विधाको ज्ञान वृद्धि तथा विस्तार गर्न अत्यन्त ठूलो भूमिका खेलेको छ । यो जर्नल प्रकाशनमा ने.भौ.स.को प्रकाशन बोर्डको ठूलो योगदान छ, त्यसको पनि म प्रशंसा गर्न चाहन्छु ।

२०७२ सालको विनासकारी भूकम्पको कारण नेपाल अत्यन्त असहज परिस्थितिमा छ र ने.भौ.स.का गतिविधि पनि त्यसबाट प्रभावित हुन सक्छन् । ने.भौ.स.को १७ औं कार्यसमितिले आगामी २ वर्षमा निम्न कार्यहरूलाई प्राथमिकता दिने छ ।

१) सदाझैं सेमिनार, वर्कसप, कन्फरेन्स र ने.भौ.स.को जर्नल तथा बुलेटिन प्रकाशन गर्ने ।

२) भू-गर्भ विषयको आवश्यकतालाई ध्यानमा राखेर सडक विभाग, नगरपालिका र जिल्लामा भू-गर्भशास्त्रीको दरबन्दी स्थापनाको लागि पहल गर्ने ।

३) समाजको आफ्नो भवन नभएको हुँदा जग्गा व्यवस्था तथा भवन निर्माण गतिविधिमा प्रयासरत् रहने ।

४) वर्तमान परिप्रेक्ष्यमा भौगर्भिक क्षेत्रमा काम गर्नेहरुको योग्यता र क्षमताको नियमन र अनुगमन गर्ने निकायको खाँचो महसुस भएकोले त्यसको लागि 'जियोलोजिकल काउन्सिल' निर्माणको प्रक्रियामा लाग्ने ।

५) २०७२ सालको गोरखा भूकम्पले प्रभावित जिल्लाहरूमा पूनर्निर्माणको लागी भौगर्भिक अध्ययन, सुझाव, सल्लाह आदि आवश्यक परि नेपाल सरकारको तर्फबाट सहयोगको अनुरोध भएमा सहयोग पुऱ्याउने, समाजका सदस्यहरूलाई सहयोग प्रदान गर्न अभिप्रेरित गर्ने ।

६) कार्यकाल अवधिभित्र भू-गर्भ विज्ञान तथा भू-गर्भशास्त्रको पेशागत हितमा आई पर्ने अन्य गतिविधिमा सक्रिय रहने/अगुवाई गर्ने ।

नेपाल भौगर्भिक समाजका सदस्यज्यूहरू तथा सम्बद्ध निकायहरूको सक्रिय सहयोग र सुझाव बिना माथि उल्लेखित लक्ष्य प्राप्ती असम्भव हुन्छ । हामी सबैलाई थाहा भएकै कुरा हो कि खानी तथा भू-गर्भ विभाग, विश्वविद्यालय, सिंचाई विभाग, नेपाल विद्युत प्राधिकरण, सिमेन्ट तथा अन्य भौगर्भिक पदार्थमा आधारित उद्योगहरू ने.भौ.स.का आधार हुन् । आजको यस कार्यक्रम मार्फत यी संस्थाहरूको नेपाल भौगर्भिक समाजको १७ औं कार्यसमितिलाई सदाझैं सहयोग रहनेछ भन्ने कुरामा विश्वास गर्दछु । सहयोगको लागि अनुरोध गर्दछु ।

मन्त्रालयको अन्य कार्य व्यस्तताको बावजुद भौगर्भिक पेशाको महत्वलाई हृदयङ्गम गरी यस कार्यक्रममा प्रमुख आतिथ्यता प्रदान गर्दै गहन मन्तव्य मार्फत् हामी भूगर्भ विधाका पेशाकर्मीहरूलाई उत्साहित पारिदिनु भएकोमा माननीय उर्जा मन्त्रीज्यू प्रति ने.भौ.स. १७ औं कार्यसमिति तथा मेरो व्यक्तिगत तर्फबाट कृतज्ञता व्यक्त गर्न चाहन्छु । त्यस्तै, अन्य अतिथि ज्यूहरू तथा समाजका सदस्यज्यूहरूको उपस्थितिले हामी सबैमा हौसला थपि दिएको छ ।

अन्तमा पुनः एकपटक ने.भौ.स. १७ औं कार्यसमितिको नेतृत्व गर्ने अवसर दिनुभएकोमा समाजका सम्पूर्ण सदस्यज्यूहरूलाई धन्यवाद दिदै आजको यस कार्यक्रमबाट बिदा हुने अनुमति चाहन्छु ।

धन्यवाद ।

२०७२.०५.११, शुक्रबार

लैनचौर, बाइक्वेयट, काठमाण्डौ ।

नेपाल भौगर्भिक समाजको सैँतिसौँ साधारण सभा एवं सत्रौँ द्विवार्षिक कार्यक्रमका केही झलकहरू

37TH ANNUAL GENERAL BODY MEETING OF THE NEPAL GEOLOICAL SOCIETY

Auditor's Financial Report (FY 2071/72 B.S.)

B.R. Ghimire & Associates
Sanogaucharan, Kathmandu
Registered Auditor
ICAN, COP No: -"GA"-559

Auditor's Report to the Members of
Nepal Geological Society
For the financial year 2071-072 (2014/015 AD)

We have audited attached Balance Sheet of Nepal Geological Society as on Ashad 31,2072 , Income & Expenditure account for the period 2071,Shrawan-1 to Ashad, 31, 2072 and report that:

1) We have obtained prompt replies to our queries including a satisfactory explanation during the course of the audit.
2) In our opinion, the organization has maintained proper books of account as require by law.
3) The Balance Sheet and Income & Expenditure account dealt with by the report are agreeing with the books of accounts maintained by the organization.
4) It has not come to our notice that any act done deliberately or otherwise the executive body or any employee of the organization in violation of law.
5) In our opinion and to the best of our information and according to the explanation given to us the said account have been correctly drawn up so as to reflect a true and fair view.

   a) In the case of the Balance Sheet, of the state of affairs of the organization as on Ashad 31, 2072
   b) In the case of Income Statement of the profit (Excess of Income over the Expenditure) for the period covering from 2071,Shrawan-1 to Ashad 31, 2072.

Date: - 2072, Bhadra-07
Place: - Kathmandu

B.R. Ghimire & Associates
Registered Auditors

37TH ANNUAL GENERAL BODY MEETING OF THE NEPAL GEOLOICAL SOCIETY

Auditor's Financial Report (FY 2071/72 B.S.)

Nepal Geological Society
Kathmandu
Balance-Sheet
As of July 16, 2015 (Ashad-31-2072)

Particulars	Sch.	Current Year (Rs.)	Previous Year (Rs.)
Liabilities:			
Surplus/(Deficit) Fund	1	6,006,273.03	4,896,313.73
Payable	2	34,020.00	231,229.55
Total		6,040,293.03	5,127,543.28
Assets:			
Bank Balance	3	5,969,831.03	5,083,601.28
Account Receivable	4	70,462.00	43,942.00
Deposit		-	-
Total		6,040,293.03	5,127,543.28

Schedule 1 to 6 form integral part of the financial statements

President | General Secretary | Treasure

B.K. Chhetri & Associates
Registered Auditors

37TH ANNUAL GENERAL BODY MEETING OF THE NEPAL GEOLOICAL SOCIETY

Auditor's Financial Report (FY 2071/72 B.S.)

Nepal Geological Society

Kathmandu

Income and Expenditures Accounts

For the period from July 17, 2014 to July 16, 2015

Particulars	Sch.	Current Year (Rs.)	Previous Year (Rs.)
Income:	5	3,650,369.80	895,614.00
Interest received		27,817.56	27,082.17
Other Income (Other Payable))		228,312.55	
Exchange Gain		253,742.61	-
Total-A		**4,160,242.52**	**922,696.17**
Expenses :			
Program Activities	6	2,218,740.77	8,750.00
Office Operating cost	7	831,542.45	1,179,247.82
Total-B		**3,050,283.22**	**1,187,997.82**
Surplus/(Deficit) C= (A - B)		**1,109,959.30**	**(265,301.65)**

Schedule 1 to 7 form integral part of the financial statements

President | General Secretary | Treasure

B.R. Gautam & Associates
Registered Auditors

37TH ANNUAL GENERAL BODY MEETING OF THE NEPAL GEOLOICAL SOCIETY

Auditor's Financial Report (FY 2071/72 B.S.)

Nep... Geological Society

Kathmandu

Cash Flow Statem...t for the Period Ended July 16, 2015

Particulars	Schedule	Amount
A) Cash From Operational Activities		
Surplus(Deficit)		1,109,959.30
Cash Flow Prior to Change in Working C...ital		
Change in Working Capit...		1,109,959.30
Increase(Decrease) in Current Liabilities		(197,209.55)
Decrease(Increase) in Current Assets		(26,520.00)
Net Change in Working C...l		886,229.75
Net Cash Flow From Oper...n		886,229.75
B) Cash Flow from Investment		
Sale/ (Purchase) of fixed Assets		-
Net Cash Flow from Inves...t		-
C) Cash Flow from financing		
Life Membership Fee		-
Net Cash Flow from Finan...g		-
...let Cash Flow		886,229.75
Opening Cash & Bank Balance		
Cash balance	-	
Bank balance		5,083,601.28
Cash balance	-	
Bank balance	5,969,831.03	
Closing Cash and Bank balance	5,969,831.03	5,969,831.03

NEPAL GEOLOGICAL SOCIETY

President General Sec...ary Treasurer

B.R. C...ttle & Associates
Registered Auditors

37TH ANNUAL GENERAL BODY MEETING OF THE NEPAL GEOLOICAL SOCIETY

Auditor's Financial Report (FY 2071/72 B.S.)

Nepal Geological Society
Kathmandu
Schedules for FY-2071/72 BS (2014/015 AD)

Schedule -1		
Particulars	**Current year (Rs.)**	**Previous year (Rs.)**
Sueplus Fund:		
Up to last year	4,896,313.73	5,161,615.38
Addition during this year	1,109,959.30	(265,301.65)
Total	**6,006,273.03**	**4,896,313.73**

Schedule -2		
Particulars	**Current year (Rs.)**	**Previous year (Rs.)**
Payable:		
TDS Audit Fee	1,500.00	2,735.00
Other Payable-USD2403.29	-	228,312.55
TDS	22,520.00	182.00
Payable for Stationery	10,000.00	-
Total	**34,020.00**	**231,229.55**

Schedule -3		
Particulars	**Current year (Rs.)**	**Previous year (Rs.)**
Cash & Bank Balance:		
NABIL Bank-Current Account	2,250,560.85	431,446.06
NABIL Bank-Current Account(USD)-$32363.07	3,236,307.00	4,249,532.40
Nepal Bank Limited-Current Account	9,949.68	9,949.68
Agriculture Development Bank-Saving Account	79,153.07	77,072.80
Nepal Bank Limited-Saving Account	60,075.44	60,075.44
Rastriya Banijya Bank-Current Account	28,784.99	15,524.90
Rastriya Banijya Bank-Term Deposit	240,000.00	240,000.00
Cheque in Transit(Receipt no.-8034,8037,8039)	65,000.00	-
Total	**5,969,831.03**	**5,083,601.28**

Schedule -4		
Particulars	**Current year (Rs.)**	**Previous year (Rs.)**
Account Receivable		
DP Adhikari (Advance)	-	25,000.00
Abhishek Dhungel (Advance)	-	15,000.00
Dinesh Pathak	20,000.00	-
Gautam Khanal	50,000.00	
Petty cash-Siva Baskota	462.00	3,942.00
Total	**70,462.00**	**43,942.00**

37TH ANNUAL GENERAL BODY MEETING OF THE NEPAL GEOLOICAL SOCIETY

Auditor's Financial Report (FY 2071/72 B.S.)

Nepal Geological Society
Kathmandu
Schedules for FY-2071/72 BS (2014/015 AD)

Schedule -5		
Particulars	**Current year (Rs.)**	**Previous year (Rs.)**
Income:		
Registration	1,813,140.80	-
Sales of Books & Journal	54,679.00	168,515.00
Contribution	830,000.00	321,580.00
Advertisement on Journal	405,000.00	125,000.00
Membership Fee	40,800.00	182,069.00
Entrance Fee	500.00	4,300.00
Contribution for Dinner	-	43,500.00
Income for Seminar	-	50,000.00
Other Income	506,250.00	850.00
Total	3,650,369.80	895,614.00

Schedule -6		
Particulars	**Current year (Rs.)**	**Previous year (Rs.)**
Program Activities		
Souvenir	272,125.00	8,750.00
Expenses for Participant	1,539,025.77	-
Seminar & Meeting	37,590.00	-
Subsistence	370,000.00	-
Total	2,218,740.77	8,750.00

Schedule -7		
Particulars	**Current year (Rs.)**	**Previous year (Rs.)**
Office Operating Cost:		
Journal publish	205,865.30	313,861.52
Books	115,760.00	342,950.00
AGM Expenses	-	250,327.00
Talk Programme Expenses	-	75,216.65
Hospitality	202,109.50	64,395.95
Notice Publication	-	31,019.00
Telephone & Internet	12,622.94	17,000.00
Printing & Stationary	114,660.00	18,845.00
Election exp	-	14,915.00
Batch	-	12,800.00
Audit Fee	10,000.00	10,000.00
Misc. Office Cost	1,700.00	11,013.44
Wages	10,600.00	8,500.00
Web Hosting Design	20,340.00	3,390.00
Transportation & Travelling	34,630.00	7,860.00
Registration & Renewal	9,930.00	1,500.00
Bank Charge	582.71	500.00
Exchange Loss	-	124.26
Advertisement	30,510.00	-
Postage	1,000.00	-
Sundry Expenses	46,147.00	-
Scholarship	10,000.00	-
Drinking Water	5,085.00	-
Total	831,542.45	1,179,247.82

LIST OF COMMITTEES

17th Executive Committee

The 17th executives elected/nominated for the two years starting from 01 September 2015 to 31 August 2017 are:

Dr. Danda Pani Adhikari	President
Mr. Mukunda Raj Paudel	Vice-President
Dr. Prem Bahadur Thapa	General Secretary
Dr. Ashok Sigdel	Deputy General Secretary
Ms. Monika Jha	Treasurer
Ms. Kabita Karki	Member
Mr. Dilandra Raj Pathak	Member
Mr. Hari Ghimire	Member
Mr. Roshan Raj Bhattarai	Member
Mr. Krishna Prasad Upadhyay	Member
Ms. Sushmita Bhandari	Member
Mr. Sobit Thapaliya	Member
Dr. Dinesh Pathak (Immediate past-president)	Member

The 17th Executive Committee has formed Editorial Board of the Journal of Nepal Geological Society and several other committees, sub-committees and representatives as below to support NGS activities:

Editorial Board of the Journal of Nepal Geological Society

Dr. Khum Narayan Paudayal	Editor-In-Chief
Dr. Hiroshi Yagi	Member
Dr. Moti Lal Rijal	Member
Dr. Ganesh Tripathi	Member
Dr. Basanta Raj Adhikari	Member
Dr. Kabi Raj Paudyal	Member
Mr. Krishna Kumar Shrestha	Member
Dr. Arjun Aryal	Member
Dr. Sudarsan Bhandari	Member

Advisory Committee

Mr. Jhumar Mal Tater	Ex-President, NGS
Mr. Gopal Singh Thapa	Ex-President, NGS
Mr. Narendra Dhoj Maskey	Ex-President, NGS
Mr. Narendra Bahadur Kayastha	Ex-President, NGS
Mr. Vinod Singh Chhetri	Ex-President, NGS
Mr. Ramesh Prasad Bashyal	Ex-President, NGS
Mr. Achyuta Nanda Bhandary	Ex-President, NGS
Dr. Amod Mani Dixit	Ex-President, NGS
Mr. Krishna Prasad Kaphle	Ex-President, NGS
Prof. Dr. Bishal Nath Upreti	Ex-President, NGS
Mr. Ramesh Kumar Aryal	Ex-President, NGS
Mr. Pratap Singh Tater	Ex-President, NGS
Dr. Ramesh Man Tuladhar	Ex-President, NGS
Prof. Dr. Megh Raj Dhital	Ex-President, NGS
Mr. Jagadishwar Nath Shrestha	Ex-President, NGS
Mr. Uttam Bol Shrestha	Ex-President, NGS
Dr. Dinesh Pathak	Ex-President, NGS

IDDR Day Organizing Committee

Mr. Moti Bahadur Kunwar	Coordinator
Er. Rick Ehlert	Member Secretary
Dr. Moti Lal Rijal	Member
Mr. Bishow Mani Pokhrel	Member
Mr. Narayan Gopal Ghimire	Member
Mr. Kaushal Kumar Jha	Member
Mr. Krishna Kumar Shrestha	Member
Ms. Indira Siwakoti	Member
Dr. Prem Bahadur Thapa	Member

Scientific Sub-committee

Mr. Rajendra Prasad Khanal	Coordinator
Mr. Nir Shakya	Member
Dr. Ananta Prasad Gajurel	Member
Mr. Surendra Raj Shrestha	Member
Mr. Churna Bahadur Wali	Member
Mr. Narayan Gopal Ghimire	Member
Dr. Ram Prasad Sharma	Member
Mr. Divas Shrestha	Member
Dr. Kamala Kanta Acharya	Member
Dr. Ashok Sigdel	Member
Mr. Rabindra Dhakal	Member
Ms. Yojana Neupane	Member
Ms. Sushmita Bhandari	Member

Geological Council Formation and Professional Development Sub-committee

Dr. Danda Pani Adhikari	Coordinator
Dr. Dibya Ratna Kansakar	Member
Mr. Govinda Sharma Pokharel	Member
Mr. Achyut Koirala	Member
Prof. Dr. Tara Nidhi Bhattarai	Member
Mr. Lila Nath Rimal	Member
Mr. Sagar Kumar Rai	Member
Mr. Shanmukhesh Chandra Amatya	Member
Prof. Dr. Lalu Prasad Paudel	Member
Mr. Rajendra Prasad Khanal	Member
Dr. Som Nath Sapkota	Member
Mr. Bala Ram Upadhyaya	Member
Ms. Kabita Karki	Member

Land Management Sub-committee

Mr. Mukunda Raj Paudel	Coordinator
Mr. Shardesh Raj Sharma	Member
Dr. Prakash Das Ulak	Member
Mr. Dinesh Nepali	Member
Mr. Ram Hari Sharma	Member
Mr. Prakash Chandra Paudel	Member
Dr. Janak Bahadur Chand	Member
Mr. Diwakar Khadka	Member
Mr. Ujjwal Raghubanshi	Member
Mr. Kumar Khadka	Member

Mr. Sudan Bikash Maharjan Member
Mr. Dilandra Raj Pathak Member
Mr. Umesh Chandra Bhusal Member
Mr. Hari Ghimire Member

IAEG National Group Sub-committee

Dr. Ranjan Kumar Dahal Co-coordinator
Mr. Subash Chandra Sunuwar Member
Dr. Prem Bahadur Thapa Member-Secretary

International Representatives

Dr. Tanka Ojha
Representative to the Geological Society of America
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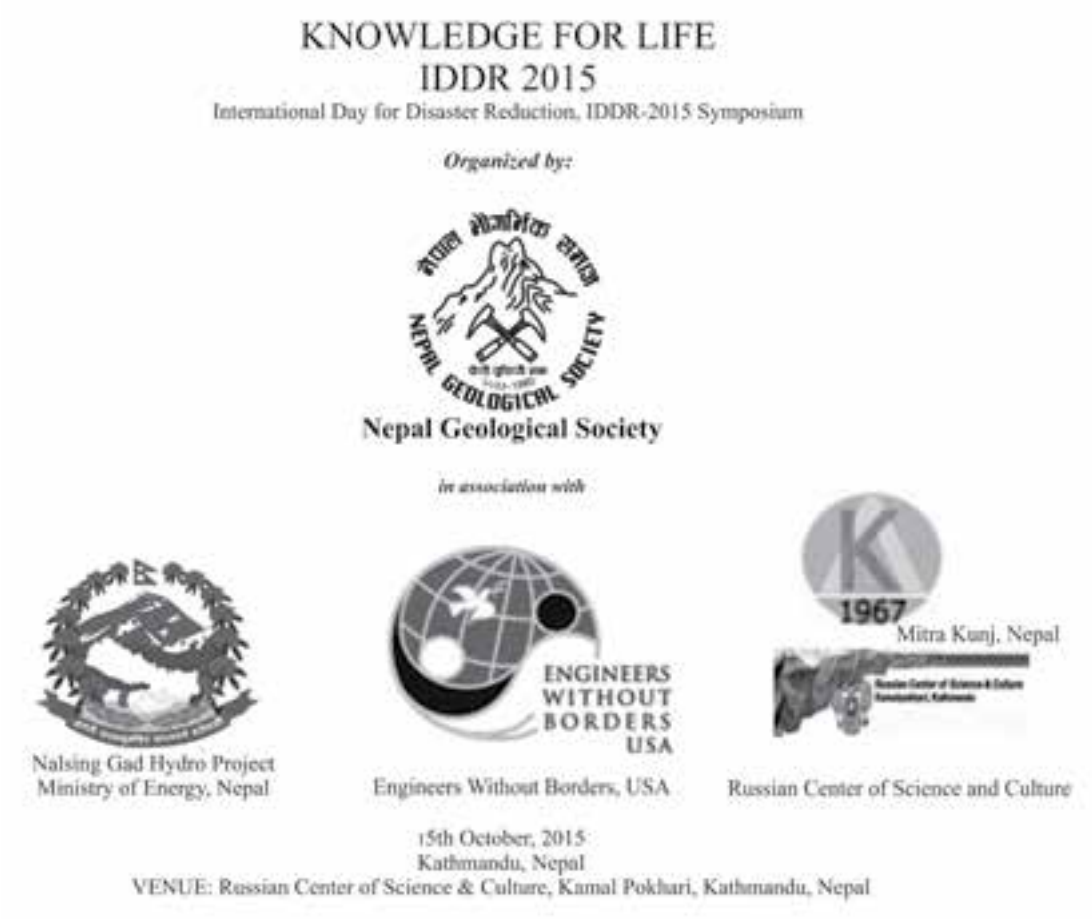

PROGRAM

MC: Dr. Prem Bahadur Thapa, General Secretary, NGS

Session	Time	Activities
Inaugural Session	09:30 - 10:00	Registration
	10.00 - 10.15	Session chairing and calling the Chief Guest, Coordinator and other Dignitaries on the dais
	10:15 - 10:20	Welcome Speech by Mr. Moti Bahadur Kunwar, Coordinator, IDDR Organizing Committee -2015
	10:20 - 10:25	Symposium Inauguration by the Chief Guest: Hon'ble Professor Dr. Govinda Raj Pokharel, Vice-Chairman, NPC, Nepal
	10:25 - 10:30	Speech by Mr. Nahendra Pradhan, President, Mitra Kunj
	10:30 - 10:35	Speech by Mr. Stanislav Simakov, Director, Russian Centre of Science and Culture
	10:35 - 10:45	Speech by Er. Rick Ehlert, South Asia Disaster Recovery Manager, Engineers Without Borders USA
	10:45 - 10:55	Speech by the Chief Guest, Hon'ble Professor Dr. Govinda Raj Pokharel, Vice-Chairman, NPC, Nepal
	10:55 - 11:10	Speech by the Session Chair, Dr. Danda Pani Adhikari, President, NGS
	11:10 - 11:15	Vote of Thanks by Mr. Mukunda Raj Paudel, Vice-President, NGS and session closing
	11:15 - 11:30	Tea

PROGRAM (Contd.)

Session	Time		Paper Presentation
Technical Session I			Chairman: Er. Rick Ehlert Rapporteurs: Dr. Moti Lal Rijal and Indira Siwakoti
	11:30-11:50	1	Non-linear response of the Kathmandu Valley sediments during the 2015 Gorkha Earthquake sequence for the given damage and destruction Sudhir Rajaure
	11:50-12:20	2	Earthquake induced landslide hazard assessment Prof. Dr. Megh Raj Dhital
	12:20-12: 40	3	Earthquake reconstruction in NEPAL: Reviving the forgotten phase of earthquake technology that required for safer housing reconstruction A. Dixit, R. Guragain, S. Shrestha and R. Dhungel
	12:40-1: 25	4	Enhancing flood early warning systems in Nepal Dinanath Bhandari
	1:25 - 2:30		Lunch Break

Session	Time		Paper Presentation
Technical Session II			Chairman: Prof. Dr. Tara Nidhi Bhattarai Rapporteurs: Mr. Narayan Gopal Ghimire and Dr. Ashok Sigdel
	2: 30-2:45	1	Building damage assessment after 2015 Gorkha Earthquake: A case of Panauti Municipality S. Adhikari, R. Guragain, S. Shrestha and S. Pradhan
	2: 45-3:00	2	3 earthquakes, 3 devastations, similar issues and resilient solutions Rick Ehlert
	3:00-3:15	3	Natural disasters in Sweden Yuliya Zhuk
	3:15-3:30	4	Active faults and associated disasters in the Nepal Himalaya: A case study of the Badi Gad Fault from Ridi-Shantipur area of Gulmi District Kabi Raj Paudyal

Concluding session	3:30-4:00		Chairman: Dr. Danda Pani Adhikari Panel Member: Mr. Moti Bahadur Kunwar and Er. Rick Ehlert

IDDR Workshop Report-2015
International Day for Disaster Reduction IDDR-Day 2015
'KNOWLEDGE FOR LIFE'

NGS AND DISASTER RISK REDUCTION ACTIVITIES

The geological hazards (earthquake, landslide, flood, etc.) are the major threats to the national development and poverty alleviation in Nepal. Therefore, Nepal Geological Society (NGS) initiated the advocacy in the area that included awareness campaign through the regular celebration of the International Day for Natural Disaster Reduction (UN/IDNDR) since 1990s, occasional publication of disaster-related booklets etc. Likewise, after the establishment of UN ISDR (United Nation International Strategy for Disaster Reduction), the Society has carried its activities in line with the UN/ISDR aims of building disaster resilient communities by promoting increased awareness of the importance of disaster reduction for reducing human, social, economic and environmental losses due to natural hazards and related technological and environmental disasters.

The activities of NGS towards Disaster Prevention was acknowledged by UN Humanitarian and Emergency Relief Co-ordination Office of IDNDR Secretariat in Geneva, by awarding UN-Sasakawa Disaster Prevention Award in 1998 for its efforts in disseminating the scientific knowledge and spreading the awareness of prevention of the natural disaster. Nepal Geological Society is committed to continue to advocate for disaster risk reduction and mitigation activities in the country. This professional organization is always open to have partnership with other national and international organizations involved in this sector.

THE IDDR DAY 2015

Nepal Geological Society (NGS) is a professional organization that is committed to work towards reducing hazard, vulnerability, and resulting disaster in the country. It has been working in disaster inventory, preparedness and advocacy since its establishment (last three decades). United Nation (UN) proclaimed the theme to celebrate disaster day 2015 as: "Knowledge for Life". Giving high priority to this theme NGS organized a half day workshop on October 15, 2015 in collaboration with Engineers Without Borders (WEB), Nalsing Gad Hydropower Project and Mitra Kunj, Russian Centre for Science and Culture.

The program was organized in the Russian Culture Center hall, Kamal Pokhari, Kathmandu. There were around 78 participations consisting of researchers, policy makers and practitioner representing various organizations working in the disaster sectors. The program was inaugurated and addressed by Hon'ble Prof. Dr. Govinda Raj Pokharel, Vice-Chairman of National Planning Commission. The program was also addressed by the distinguished guests. The workshop was divided into two sessions namely Inauguration Session and Technical Session. There were two technical sessions, each followed by discussion over the queries of the participants. Finally, the workshop was concluded by wrap up session.

INAUGURAL SESSION

The Inaugural session was chaired by Dr. Danda Pani Adhikari, President of NGS and the program was inaugurated by Hon'ble Prof. Dr. Govinda Raj Pokharel, Vice-Chairman of National Planning Commission, Government of Nepal. The speakers in the inauguration session were Prof. Dr. Govinda Sharma Pokharel; Dr. Danda Pani Adhikari, President-Nepal Geological Society; Mr. Moti Bahadur Kunwar, Convener, NGS-IDDR-2015, and other distinguished guests.

Mr. Moti Bahadur Kunwar, Convener of IDDR 2015 is delivering welcome speech.

Er. Rick Ehlert is delivering speech in inaugural session of IDDR 2015.

All the speakers focused on the role of professional society and disaster risk reduction as well as the themes of UN/ISDR. Dr. Prem Bahadur Thapa, NGS General Secretary, conducted the Inaugural Session and vote of thanks was delivered by Mr. Mukunda Raj Paudel, Vice-President of NGS.

Mr. Moti Bahadur Kunwar, Convener of the NGS-IDDR Committee delivered welcome speech on behalf of the organizing committee. Mr. Kunwar welcomed all the guests, resource persons and participants in the workshop. In his welcome speech Mr. Kunwar shaded light on the main objectives of the workshop focusing on the theme given by the UN for this year "Knowledge for Life". He also reiterated that Nepal Geological Society has long been recognized for research initiatives, regular publication, and organization of national/ international seminars, workshops and has contributed in development and disaster mitigation endeavors. He stressed on the relevancy of the theme in view of the necessity to focus our disaster risk reduction activities to utilize the traditional, indigenous and local knowledge and practices, to complement scientific knowledge in disaster risk management.

Mr. Kunwar mentioned that IDDR Day has been observed by NGS since long, especially focusing on interactive workshop and seminar with view to share the knowledge and practices of disaster management and to generate awareness among the stakeholders. In addition, he mentioned that the invited papers from academia, researcher and practitioner are equally important issues to be covered for the disaster management. He believed that at the end of the workshop NGS will be able to produce a report with assessment of our present capacity, identifying substantial activities to be done and practical recommendations to decision makers and planners.

Er. Rick Ehlert from Engineers Withou Borders (EWB) highlighted the different approaches of using knowledge for life especially the sustainable engineering techniques in reconstruction strategies after the large-scale disaster. He also discussed examples of best practiced reconstruction process in different countries.

Chief Guest, Prof. Dr. Govinda Raj Pokharel is giving speech in IDDR 2015.

Hon'ble **Prof. Dr. Govinda Raj Pokharel**, Vice-Chairman of National Planning Commission as well as the Chief Guest of the IDDR Day 2015 mentioned the theme is highly relevant in Nepalese context. He pointed out the need of formulation of new and review of the existing disaster related government policies to incorporate the various aspects of knowledge for life. He also wished for the success of the workshop and expected strong suggestion and recommendation from the workshop to the policy makers and the practitioners for re-building nation that devastated by the Gorkha Earthquake of April 25, 2015.

Dr. Danda Pani Adhikari, Chairman of the session and President of NGS thanked the participants for their presence in spite of their busy schedule. He stressed that Nepal is geologically situated in a zone that is vulnerable to natural disaster. Because of this reason, NGS has been celebrating IDNDR and IDDR Days in cooperation with the concerned government and non-government organization so as to disseminate the information about disaster to the general public. Dr. Adhikari said, the Society is still committed to its objective towards disaster risk reduction and has been continuously involved in various related activities.

Dr. Danda Pani Adhikari, NGS President is highlighting the IDDR 2015 program.

Dr. Adhikari focused the theme of year 2015 to use knowledge for life. Different kinds of indigenous and local knowledge in the society which are very useful while planning disaster risk management. He mentioned that, in view of geographical and geological condition, Nepal is prone to hit by disaster and has experienced several such incidents in the past (2014 Jure landslide in Sindhupalchawk, 2015 Gorkha Earthquake are the recent deadliest examples in Nepal). In this context, NGS has organized this 2015 IDDR workshop in order to discuss the role of knowledge in disaster management and also to explore the ways how to save life from people's perception. The session Chair in his concluding remarks highlighted the importance of geology in disaster risk reduction. He also stressed that various branches of geosciences especially engineering geology can play specific role in disaster sector and hence it is urgent to form geological council so as to regulate, monitor and safeguard their role in various activities in the country and seek government support in this endeavor of the Society.

He also acknowledged the partnership between Nepal Geological Society, Government bodies, local governments as well as Mitra Kunj, Russian Center of Science and Culture, Nalsing Gad Hydropower Project and Engineers Without Borders.

Dr. Prem Bahadur Thapa, General Secretary of NGS conducted the whole program with prioritizing the theme of the IDDR-2015 Symposium and **Mr. Mukunda Raj Paudel,** Vice-President of NGS gave vote of thanks with thanking to the Chief Guest, other guests, participants and collaborative organizations for their support and participation in the ISDR Day organized by the Nepal Geological Society.

Dr. Prem Bahadur Thapa, General Secretary of NGS is conducting the IDDR 2015 Program.

Mr. Mukunda Raj Paudel, NGS Vice-President is delivering the vote of thanks.

TECHNICAL SESSION

The First technical session was chaired by Er. Rick Ehlert, Engineers without Borders (EWB) from United States. The rapporteurs were Dr. Moti Lal Rijal (Central Department of Geology, Tribhuvan University) and Indira Siwakoti (Nepal Electricity Authority).

In this first session, three technical papers entitled (1) Non-linear response of the Kathmandu valley sediments during the 2015 Gorkha Earthquake sequence for the given damage and destruction by Mr. Sudhir Rajaure from Department of Mines and Geology; (2) Earthquake induced landslide hazard assessment by Prof. Dr. Megh Raj Dhital from Central Department of Geology, Tribhuvan University; (3) Earthquake reconstruction in NEPAL: Reviving the forgotten phase of earthquake technology that required for safer housing reconstruction by Ranjan Dhungel from Nepalese Society of Earthquake Technology (NSET), (3) Enhancing flood early warning systems in Nepal by Dinanath Bhandari from Practical Action.The first speaker of this session, Mr. S. Rajaure during his presentation discussed the strong motion records of the 2015 Gorkha Earthquake sequences to investigate ground response of the Kathmandu Valley sedimentary basin. He found that the Kathmandu valley sediments have responded non-linearity during Gorkha Earthquake sequence. Second Speaker, Prof. **Dr. M. R. Dhital** elaborated earthquake-induced landslides triggered by 2015 Gorkha Earthquake and their relationship with peak ground acceleration (PGA) values whereas third speaker Mr. D. Bhandari described the enhancing flood warning system and their status in Nepal. According to him, the early warning system (EWS) is operational at different status for the flood plain communities in the major river basins in the Nepal.

Ms. Yuliya Zhuk, a speaker from Sweden, is presenting her paper.

Participants in the IDDR-2015 Symposium at Russian Culture Centre Hall, Kathmandu.

The second technical session was chaired by **Prof. Dr. Tara Nidhi Bhattarai,** Department of Geology, Tri-Chandra Campus, Tribhuvan University. The reporters were Mr. Narayan Gopal Ghimire and Dr. Ashok Sigdel (Nepal Electricity Authority). In this session, four technical papers entitled (1) Building damage assessment after 2015 Gorkha

Earthquake: A case of Panauti Municipality by Mr. S. Adhikari from Nepalese Society of Earthquake Technology (NSET); (2) 3 earthquakes, 3 devastations, similar issues and resilient solutions by Er. Rick Ehlert from Engineers Without Borders, USA; (3) Natural disasters in Sweden by Ms. Yuliya Zhuk from Uppsala University, Sweden and (4) Active faults and associated disasters in the Nepal Himalaya: A case study of the Badi Gad Fault from Ridi-Shantipur area of Gulmi District by Dr. Kabi Raj Paudyal from Central Department of Geology, Tribhuvan University.

Audiences are participating in discussion following presentations.

Group photograph of 17th Executive Committee with Er. Rick Ehlert from USA.

In 2nd technical session, first speaker, Mr. S. Adhikari discussed the natural disaster are not certain, they could occur anytime and seriously disrupts the functioning of a community causing huge loss, therefore during the time of crisis the collection and dissemination of damaged data are crucial. Second speaker, **Er. R. Ehlert** elaborated the large-magnitude earthquakes have devastating impact to people, economies, infrastructure, homes, businesses, and community which requires advance preparation by people and communities to withstand the impacts of these major events. **Ms. Y. Zhuk** was the third speaker who discussed the overview of past and present challenges caused by natural disaster in Sweden. The last speaker, **Dr. K. R. Paudyal** showed importance of active fault their relationship to cause disaster in the Nepal Himalaya. According to him, identification and characterization of active faults in the Himalaya have a great value for the assessment of natural disaster like earthquake, landslide, soil erosion, and flood.

WRAP UP SESSION

After completion of presentations in two technical sessions, Dr. Danda Pani Adhikari, the Chairman of the NGS wrap up the session together with two panel members (Mr. Moti Bahadur Kunwar and Er. Rick Ehlert) pointed out the importance of the Theme of the Workshop and related research papers presented in the Technical Session and their main findings and conclusions. At that time he mentioned that all the presentations and follow up discussions were interesting and fruitful. He mentioned, it was wonderful opportunity for us to learn more regarding Geoscience, disaster and the knowledge of the people for life. Government must give high priority in pre-disaster preparedness as well as post-disaster rescue and relief and recovery of disaster victims at the earliest possible. It will be better to: (1) raise awareness of the use of traditional, indigenous and local knowledge and practices, to complement scientific knowledge in disaster risk management and (2) highlight approaches for engaging local communities and indigenous peoples in implementation of the Sendai Framework for Disaster Risk Reduction.

International Day for Disaster Reduction (IDDR)-2015
Welcome speech by Mr. Moti Bahadur Kunwar, Coordinator, IDDR committee, NGS

Chairman of the inaugural session and President of NGS, Dr. Danda Pani Adhikari
Chief Guest, Honorable Prof. Dr Govinda Raj Pokharel, Vice-Chairman, NPC, Nepal
Mr. Stanislav Simakov, Director, Russian Centre of Science and Culture
Er. Rick Ehlert, South Asia Disaster Recovery Manager, Engineers Without Borders (EWB), USA
Mr. Nahendra Pradhan, President, Mitra Kunj
Respected honorary member of NGS
Past presidents of NGS
Distinguished guests
Senior government officials of Nepal
Dear fellow members of the Society

Ladies and gentlemen!

It is my great pleasure to welcome you all in this symposium organized on the occasion of International Day for Disaster Reduction (IDDR Day- 2015). This meeting and the symposium following this session is being organized in collaboration with Nalsing Gad Hydropower Project, Ministry of Energy, Government of Nepal, Engineers without Borders USA, Mitra Kunja and Russian Center of Science and Culture.

I would like to thank you all very much for kindly accepting our invitation to attend this program. On behalf of the IDDR day- 2015 organizing committee and my own, I would like to welcome all of you in this program.

We all know that the UN General Assembly in 1989 had declared the decade of 1990-2000 as the International Decade for Natural Disaster Reduction and second Wednesday of October as the International Day for Natural Disaster Reduction (IDNDR). The International Day for Disaster Reduction (IDDR, formerly ISDR) symposium is one of the activities NGS has been observing regularly each year in collaboration with different organizations since 1999.

The UN designated date to celebrate the IDDR is October 13th, but we have decided to observe the event this year today because October 13th was GHATASTHAPANA, the first day of Dashain festival. The Step Up initiative started in 2011 with focus on children and young people (2011), women and girls (2012), people living with disabilities (2013) and the ageing population (2014). The theme of this year's IDDR-day is Knowledge for life with focus on the use of traditional indigenous and local knowledge which complement modern science and add to an individual's and societies' resilience. The theme of the IDDR-day for this year is very much relevant to match the aftermath of 2015 Gorkha Earthquake in Nepal as we have to increase knowledge on disaster risk reduction.

Ladies and Gentleman,

At the beginning NGS was the only organization to celebrate the IDNDR-day by organizing several activities in collaboration with Ministry of Home Affairs, Government of Nepal. Later, other professional societies, NGO and INGO started to celebrate this day. From the IDDR concept, disaster awareness level has increased in Nepal because of varieties of publications, trainings and other awareness activities in which Nepal Geological Society contributed significantly. We should not forget that we are located in a natural disaster prone country which is reminded by the 2015-Gorkha earthquake. We need to reduce disasters by increasing knowledge and raising public awareness and developing new technology to protect life and property.

Finally, I would like to welcome you all once again and extend my thanks to Nepal Geological Society, 17th Executive Committee for providing me the responsibility to serve as the coordinator of the IDDR- day 2015.

Thank You!
October 15, 2015
Kathmandu, Nepal

International Day for Disaster Reduction (IDDR)-2015, Inaugural Session Speech by Dr. Danda Pani Adhikari, President, NGS

Chief Guest, Honorable Prof. Dr Govinda Raj Pokharel, Vice-Chairman, National Planning Commission (NPC), Nepal
Mr. Stanislav Simakov, Director, Russian Centre of Science and Culture, Nepal
Mr. Moti Bahadur Kunwar, Coordinator, IDDR-2015 Committee and Director, Nalsing Gad Hydropower Project (NGHP), Ministry of Energy (MoE), Nepal
Er. Rick Ehlert, Secretary, IDDR-2015 Committee and South Asia Disaster Recovery Manager, EWB (USA)
Mr. Nahendra Pradhan, President, Mitra Kunj, Nepal
Respected honorary members and past president of NGS
Distinguished guests
Senior government officials
Representatives of different organizations
Fellow NGS members
Media persons
Ladies and Gentlemen,

The International Day for Disaster Reduction (IDDR, formerly ISDR) symposium is one of the activities the Nepal Geological Society (NGS) has been observing regularly each year since early 1990s. IDDR was introduced by the UN to (1) identify how people and communities can reduce their exposure to disasters and (2) to raise awareness about the importance of Disaster Risk Reduction (DRR). As our symposium coordinator, Mr. Moti Bahadur Kunwar highlighted, the UN theme of the 2015 IDDR is "Knowledge for Life." The focus of 2015 IDDR is use of traditional, indigenous and local knowledge to complement modern science and add to an individual's and societies' resilience. Given the symposium is taking place in the aftermath of 2015-Gorkha earthquake, this year's theme is very relevant for Nepal as knowledge acquisition is important for human life sustainability and is a first step for long-term positive change.

We live in a multi-hazard- prone country, where geological (earthquake, landslide, debris flow, glacial lake outburst flood-GLOF) and hydro-meteorological events are common and result in a large loss of life, property damage, environmental damage, and economic losses. The 2015-Gorkha earthquake was one such event and it demonstrated how vulnerable the Himalayan region can be when major earthquakes strike. Active geodynamic process is one of the reasons for Nepal's vulnerability to disaster. Therefore the role and responsibility of geologists is extremely important to reduce the risks to natural disasters.

Sustainable development cannot be achieved unless disaster risk is reduced. Disaster-related loss of life and property is increasing each year in the world with over 80 % of the total loss distributed across low and middle-income countries. The ongoing climate change the world is experiencing is expected to increase future losses. Through changing temperatures and precipitation, amongst other factors, global climate change is already modifying hazard levels and exacerbating disaster risks. The extreme weather events happening around the world are not by chance. The world has entered into a new normal. For example, extreme events like hurricanes, tropical cyclones, drought, intense precipitation, flood etc. are getting more frequent and larger compared to past events. Many of today's extreme events will become tomorrow's everyday reality. There may be a lot of disaster surprises that we will not be prepared to handle. For all these reasons 'Knowledge for Life' is very relevant to this year's theme of disaster risk reduction.

Ladies and Gentlemen!

In the aftermath of 2015-Gorkha earthquake, the Post Disaster Needs Assessment (PDNA) conducted by the National Planning Commission has estimated that the total value of disaster effects (damages and losses) caused by the earthquakes is NPR 706 billion or its equivalent of US$ 7.0 billion. And this economic loss doesn't include the effects associated with loss of life and tremendous suffering. Seismologists say the 2015-Gorkha earthquake was a wake-up-call. Even larger earthquake disasters may occur and we need to be prepared. That is not all. The Nepali people are victims of frequent major political earthquakes with powerful foreshocks and aftershocks! If the current political climate continues as business as usual, we can't build Nepal back better. Unfortunately, it appears that the national desire to build back better is quickly being replaced by business as usual. This inadequate attitude bears the question - how many wake-up-calls do we need before the values of resilience and sustainability become important?

With this backdrop, we have no alternatives other than to act responsibly to reduce Nepal's risk to natural disaster. The people attending this symposium today represent influential institutions capable of making large differences in disaster risk reduction, provided we work together. This symposium is an effort to share knowledge and experiences toward reducing

disaster risk and improving Nepal for future generations.

The starting point for reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic and environmental vulnerabilities. Education, and in particular, formal education, can provide a strong foundation to enable individuals to understand disaster risks. Disaster impacts can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience. This, in turn, requires the collection, compilation and dissemination of relevant knowledge and information on hazards and vulnerabilities. To support the disaster risk reduction activities, NGS members have been involved in the geohazard assessment of areas affected by the 2015-Gorkha earthquake, and I myself visited the epicenter area soon after the earthquake. In addition, NGS members have been involved in the deployment of GPS monitoring equipment and seismographs to generate 'Knowledge for Life.'

The NPC requested the NGS to undertake geological/ engineering geological investigation of the affected areas as part of the reconstruction activities. Prof. Pokharel, NPC Vice-Chair was one of the key personalities who realizes the importance of geology in reconstruction. Fortunately, we had fewer landslides during the 2015monsoon season than we had expected in the earthquake affected areas. But this is not to say the areas won't see more landslides in years to come. To understand how at-risk geological features will behave in the future, the affected area needs thorough geological investigation. Thus, there is a desperate need for geological and engineering services and expertise not only in the affected areas, but the remainder of Nepal as well. This need is difficult to comprehend unless one visits the affected areas to see the heart breaking reality.

NGS has many resources that are not available through other institutions in Nepal, i.e., our international members and collaborators who have the state-of-the-art techniques in dealing with disaster reductions. These collaborators provide substantial knowledge from other world-wide disaster events, and we can apply that knowledge in Nepal to aid with the recovery. The involvement of EWB in organizing this symposium is an example of our expanding partnership with international institutions. The name is self-explanatory that it has no borders and that is why EWB has joined with us in the aftermath of 2015- Gorkha earthquake. The NGS met Er. Rick Ehlert and Er. Kevin Hagen from EWB to discuss how a collaborative efforts can reduce disaster risk in advance and build back better post-disaster as geologists and engineers.

Despite tremendous inconvenience and suffering in daily life due to the ongoing petroleum shortage, everyone here has kindly accepted our invitation to become part of the IDDR- 2015 celebration. This truly indicates the value you place on NGS activities and your commitment to disaster risk reduction. I am grateful to the Chief Guest, Honorable Prof. Dr Govinda Raj Pokharel for his time and inspiring talk. I thank you all again for your gracious presence. In the technical sessions following, we will cover works on different types of disasters in Nepal and other parts of the world, including early warning systems and structural measures. We have very resourceful papers. Er. Rick Ehlert from EWB is sharing his international experiences following the New Zealand and Haiti earthquakes. His experience can provide valuable lessons for the reconstruction of the earthquake-affected areas in Nepal. Please stay with us for this.

Despite living with the deep pain of the 2015-Gorkha earthquake and other conveniences, great Nepali festivals are at our doorstep. On this occasion, I wish you a very "Happy Vijaya Dashimi and Happy Dipawali" on my own and on behalf of the NGS 17th Executive Committee. May Goddes Durga and Laxmi give us power, wealth, knowledge, and wisdom to build back better in recovery and disaster risk reduction!

Thank you.
October 15, 2015
Kathmandu, Nepal

Vote of thanks by Mukunda Raj Paudel, Vice-President Nepal Geological Society (IDDR Day 2015)

Respected Chairman and President of Nepal Geological Society
Honorable Chief Guest Prof. Dr. Govinda Raj Pokheral, Vice-chairman of National Planning Commission
Distinguished Guest
Coordinator of IDDR council of NGS Mr. Moti Bahadur Kuwar
President of Mitra Kunja Mr. Nahendra Pradhan
Director of Russian center science and culture Mr. Stanislav Simakov
South Asian Disaster Recovery Manager Er. Rick Ehlert
Respected Honorary Member of NGS and Past President of NGS
Senior Government Officials of Nepal
Dear Fellow members of the Society

Ladies and Gentlemen,

On behalf of Nepal Geological Society, I am privileged to extend my sincere gratitude to all the distinguished guests and the participants of this one day National meeting cum workshop on observing the IDDR Symposium 2015.

Now, we are here to observe the IDDR Day 2015. This meeting and the following seminar is being organized in collaboration with Nalsing Gad Hydropower Project, Ministry of Energy of Nepal, Engineers without Border USA, Mitra Kunja and Russian Center of Science and Culture. Allow me first to congratulate the Nalsing Gad Hydropower Project, Engineer without Border USA for jointly collaborating with the Nepal Geological Society along with Mitra Kunja and Russian Center of Science and Culture to make this important day meaningful and also fruitful.

I realized that the theme of this IDDR day "Knowledge for Life" is very appropriate to this occasion during the present natural disaster and manmade disaster condition of Nepal. On behalf of Nepal Geological Society, I extend my profound gratitude to our Chief Guest Prof. Dr. Govinda Pokharel, Vice chairman of NPC for his message and inauguration of this workshop.

The Society is very grateful to Mr. Moti Kuwar, Chief of Nalsing Gad Hydropower Project and all staff of the Project for their support to conduct this program.

I also offer my sincere thanks to Er. Rick Ehlert, Engineers Without Boarder for their important speech and collaboration and financial help in organizing today's program. Our sincere thanks are also due to providing this venue for today's meeting to the Russian Center of Science and Culture, Director of this center

We also extend our sincere thanks to Mr. Nahendra Pradhan, President of Mitra Kunja for valuable speech and various cooperation to conduct this program. Nepal Geological society would like to extend its sincere gratitude to all the high officials of Government of Nepal, Distinguished Guest, all media groups for being with us in this today's program.

I also offer my sincere thanks to the all member of NGS, government agencies, different other organization and individuals for their kind support and cooperation in all activities of the society.

Lastly, we offer our apologies for inconveniences that may have occurred during the program. Now, I have taken permission from the chairman of this program to close the inaugural session and invite you for tea and coffee outside the hall.

Once again thank you, thank you all !

ABSTRACTS OF THE IDDR SYMPOSIUM 2015 PRESENTATIONS

Non-linear response of the Kathmandu Valley sediments during the 2015 Gorkha Earthquake sequence for the given damage and destruction

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Strong motion records of the 2015 Gorkha Earthquake Sequence are analyzed in order to investigate the ground response of the Kathmandu Valley sedimentary basin. We present and interpret the strong motion records of the Mw 7.8, Mw 7.3, Mw 6.7 and Mw 6.5 earthquakes recorded at one reference rock site and four soil sites in the Kathmandu sedimentary basin. Records of ground acceleration at soil sites from all four earthquakes show systematic amplification relative to the rock site in the frequency range between 0.1 to 2.5 Hz at multiple frequencies and de-amplification in the frequency range larger than 2.5 Hz. The soil/rock spectral ratio for the Mw 7.8 and Mw 7.3 events is smaller in comparison to that in the case of the Mw 6.7 and Mw 6.5 events. Thus, the Kathmandu Valley sediments have responded non-linearly during the Gorkha Earthquake sequence.

Earthquake reconstruction in NEPAL: Reviving the forgotten phase of earthquake technology that required for safer housing reconstruction

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There is a need of about 700,000 buildings reconstruction because of April 25, 2015 Gorkha Earthquake which caused huge damage to buildings killing about 9000 people. Now, the country is in the process of reconstruction. Incorporating disaster risk reduction and resilience into the design of recovery programs will help to build long-term disaster resilience in Nepal. Providing a blanket technical assistance is a key to insure 'build back better' concept. A robust system of technical assistance is required to reach to every household of all the communities and VDCs of the 14 affected districts. The system must consider a cascading system of training, a massive awareness campaign, standard curricula, technical guidelines and manuals and also a management system that provide the flexibility to complement and cooperate among the organizations. With this concept of developing a system to provide blanket technical support to affected communities, NSET piloted a program called "Technical Support for Earthquake Safer Housing Reconstruction in Nepal (TSESHR)" funded by USAID/OFDA in Dolakha district. Revision of Training curricula (Basic courses and instructor development courses) to fit to rural area; development of standard designs and guidelines for reconstruction; Piloting some training programs based on the revised curricula and drawing lessons on what works what doesn't were the main activities of the program. Establishment of Reconstruction Technology Centers (RTCs) and Mobile Teams for effective training system were also piloted. The program was implemented together with Local Authorities. This paper highlights the need, the proposed technical assistance program, the activities conducted and the lessons learned. The lessons will be useful to expand the program to all affected area with some adaption based on the lessons.

Key words: Housing Reconstruction, Mason Training, Earthquake Technology

Enhancing flood early warning systems in Nepal

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There have been advancement in technology and approaches in early warning systems (EWS) particularly on weather-induced hazards such as flooding. Nepal is one of the most vulnerable countries to flood vulnerability. It has potential of such system in saving lives through monitoring and informing flood risk with the downstream communities. The EWS has evolved through community cantered approaches in Nepal taping technological opportunities for last a decade Currently, the EWS is operational at different status for the flood plain communities in major river basins in Nepal. However, social and vulnerability context is important in utilization of technologies in addition to its effectiveness and application. Social and financial appropriateness of technology is important to sustainability and advancement of technologies in community based systems. It is crucial consideration if the technology is to be used as common property resource where utilization is shared to all and individual benefit is not directly measurable. Frequency of flooding also affected community concern to the technologies and the system where concerns of humanitarian authorities (DDRC in particular) were difficult to layout. While vulnerable communities are interested, they have less capacity to focus on to the system or component. Currently department of Hydrology and Meteorology (DHM) is implementing flood risk monitoring and communication of flood risk. While DHM can act as lead agency to forecast, monitor and disseminate the risk information. This presentation will share experience of flood EWS initiatives implemented in rivers basins in Nepal and put forward issues for future consideration.

3 earthquakes, 3 devastations, similar issues and resilient solutions

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Regardless of where large-magnitude earthquakes occur, there is usually a devastating impact to people, economies, infrastructure, homes, businesses, and community. Advance preparation by people and communities to withstand the impacts of these major events is usually inadequate, based in risk denial, economics, poor standards, deficient earthquake education, or misguided human characteristics. This presentation will expose problems common to the earthquakes in Haiti, New Zealand, and Nepal based on observations and experiences in each region. Lessons are learned from each event and should be shared with responding organizations and agencies, communities at risk, educators, governments, and donors. We suggest that proactive, realistic, and coordinated preparedness efforts will save lives and provide resilience with better outcomes in future earthquake events.

Building damage assessment after 2015 Gorkha Earthquake: A case of Panauti Municipality

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Natural disasters are not certain; they could occur anytime and seriously disrupts the functioning of a community causing huge loss. However, during the time of crisis the collection and dissemination of damaged data are crucial. Rapid but accurate assessment of the buildings in the aftermath of earthquake is critical for an effective and timely response. A part from human knowledge, new technology can also provide important inputs for any disaster management plan. Thus, this paper illustrates the utilization of technology (mobile and Google earth imaginary) to collect post disaster damage information within short span of time. Technologies and damage detection methods helps to uplift post disaster response activities through rapid damage assessment.

Key words: Building damage assessment, Gorkha Earthquake, post disaster

Active faults and associated disasters in the Nepal Himalaya: A case study of the Badi Gad Fault from Ridi-Shantipur area of Gulmi District

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A large number of active faults have been reported in the Nepal Himalaya by several geoscientists in the past. Identification and characterization of these active faults have a great value for the assessment of natural disasters like earthquakes, landslides, soil erosion and floods. Safety of critical establishments like hydro-power plants and lifeline structures is the major concern in these areas. Assessment and better characterization of such faults help to mitigate the impacts of various geological disasters. Present study has aimed to locate the Badi Gad Fault and associated hazards along the Ridi-Shantipur area, a previously least studied section of the Lesser Himalaya. Both aerial photo interpretation and field observation were carried out for the mapping of the fault throughout the area. It is found as a strike-slip type fault as mentioned earlier. There are several geological as well as geomorphic signatures to locate the fault in the region. Some of the most remarkable geological features include the shear zones, rock deformation, fault gauges, fault breccias, slickenside and lineation. Similarly, some of the noteworthy fault-related geomorphic features in this area include the diversion of stream courses, extension of fault-controlled linear depression, clustering of landslides along a certain region and in-line alignment of springs. Presence of small to large and several active landslides in the region has caused a great damage to only one access road of the area. Landslide has also caused for losing the fertile soil, vegetation in addition to threatening of human settlements.

Natural disasters in Sweden

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When vulnerable elements, such as population, property, infrastructure or environment come on the way of natural events, they can cause serious disasters. This presentation gives a short overview of past and present challenges caused by natural disasters in Sweden. Though Sweden has less seismic activity than Nepal, it experiences minor earthquakes annually. The strongest earthquake registered had a magnitude of 4.8, a depth of 10 km and occurred 29 years ago in the town of Skövde in south Sweden. Moreover, Sweden experiences other natural disasters: landslides, floods, forest fires and erosion. I give a short summary about each of them following a brief background. My presentation also contains information about disaster risk reduction and mitigation efforts in Sweden. The vulnerability of society in the face of natural disasters is expected to increase as a result of climate change, population increase, and urbanization. I give a short introduction to future challenges that may cause by the climate change in Sweden.

Abstracts of the Scientific Talk Program Organized by Nepal Geological Society

(19th January, 2016)

Landslide Deformation Character Inferred from Terrestrial Laser Scanner Data

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The stability of many large landslides is mainly determined by surface deformation and subsurface deformation along buried slip surfaces. Therefore, better understanding of landslide stability and governing processes requires good knowledge of ground deformation but acquiring this information is challenging. Three dimensional point-cloud data from terrestrial laser scanning (TLS) show potential for obtaining 3D ground displacements accurately. Problems arise, however, when estimating continuous displacement fields from TLS data because reflecting points from sequential scans of moving ground are non-unique, thus repeat TLS surveys typically do not track individual reflectors. Here, the cross-correlation-based Particle Image Velocimetry (PIV) method is implemented to derive 3D surface deformation fields with associated errors using TLS data. The method is applied to the toe of the episodically active Cleveland Corral landslide in northern California using the TLS data acquired in June 2005–January 2007 and January–June 2010. Estimated displacements range from decimeters to several meters, and they agree well with independent measurements at better than 9% root mean squared (RMS) error. For each of the time periods, the method provides a nearly continuous displacement field and permits further analysis. The hypothesis that the subsurface slip geometry can be constrained by ground surface displacements is tested. Two mechanically distinct forward models, a 2-D balanced cross-section method and an elastic dislocation model, are applied and the efficacy of these models to estimate slip depth and slip magnitude of the slide is tested. The estimated slip surface depth using both methods matches in situ observations from shear rods installed in the slide within the ±0.45 m misfit indicating that these are valuable approaches for investigating landslide geometry and slip behavior. Such information enables assessment of the hazards posed by large, slow-moving landslides.

Aftershock sequence of Gorkha Earthquake 2015

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On 25 April 2015 at 11:56 AM local time, a large earthquake of Magnitude M7.8 (ML 7.6) occurred with epicenter at Barpak of Gorkha district, Nepal. Epicenter of this devastating earthquake lies about 75 km north-west of Kathmandu, the capital city of Nepal and at the rim of the High Himalayan range. The earthquake claimed about 9000 deaths and more than 6,00,000 houses were destroyed. More than 400 aftershocks of magnitude greater than 4 ML have been recorded and still aftershocks are frequent in the region. The distribution of aftershock defines a main 140 km long ESE trending structure, parallel to the mountain range. In addition to the main region illuminated by the aftershocks, we observe a second seismicity belt located southward, under the Kathmandu basin and northern part of the Mahabharat Range. Many aftershocks within this belt have been felt by the 3 million inhabitants of the Kathmandu valley.

Abstracts of the Scientific Talk Program Organized by Nepal Geological Society

(4th March, 2016)

Ground response of the Kathmandu Sedimentary Basin during the 2015 Gorkha (Nepal) Earthquake Sequence

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An earthquake of Moment Magnitude (Mw) 7.8 occurred at 11:56 local time in the western part of Grokha District in Western Nepal on the 25th April 2015. This earthquake as well as its strong aftershocks caused massive destruction in the northern part of hilly region as well as in the Kathmandu Valley. This is the first destructive earthquake, which occurred in Nepal and is recorded by modern instruments. The earthquake sequence, so far, has been reported to have claimed more than 8500 lives leaving thousands injured and similarly tens of thousands homeless. The ground motion of the earthquake was recorded by five accelerometers installed in the Kathmandu sedimentary basin. Four accelerometers were installed by a collaborative project between Tribhuvan University, Nepal and Hokkaido University, Japan and the other accelerometer was installed by the United States Geological Survey, USA. One of the accelerometer is at bedrock and other four are at soil sites. We have analyzed strong motion records of the 25 April 2015 Nepal Earthquake (Mw 7.8) and its three strong aftershocks recorded at one rock (reference) site and four soil sites in the Kathmandu Valley. Strong motion data at soil sites from all four events show systematic amplification relative to the rock site at multiple frequencies in the 0.1 to 2.5 Hz frequency range and de-amplification of frequencies larger than 2.5 Hz. The amplification ratio between a soil site and a reference rock site for the Mw 7.8 and Mw 7.3 events have smaller amplitude and frequency peaks relative to the ratios of the two other moderate events, thus, indicating nonlinear site response during the stronger events.

Repeated catastrophic valley infill following medieval earthquakes in the Nepal Himalaya

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Geomorphic footprints of past large Himalayan earthquakes are elusive, though urgently needed for gauging and predicting recovery times of seismically perturbed mountain landscapes. We present evidence of catastrophic valley infill following at least three medieval earthquakes in the Nepal Himalayas. Radiocarbon dates from peat beds, plant macrofossils, and humic silts in fine-grained tributary sediments near Pokhara, Nepal's second largest city, match the timing of nearby M > 8 earthquakes in ~1100, 1255, and 1344 C.E. The upstream dip of tributary valley fills and X-ray fluorescence spectrometry of their provenance rule out local sources. Instead, geomorphic and sedimentary evidence is consistent with catastrophic fluvial aggradation and debris flows that had plugged several tributaries with tens of meters of calcareous sediment from a Higher Himalayan source >60 km away.

ARTICLES

Initiatives for Rockfall Hazard Mitigation in Nepal

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ABSTRACT

Rockfall hazards are serious geo-engineering challenges in Nepal but very less progress has been made till date to mitigate such problems either with modern engineering solutions or with low cost technologies. In this paper, few initiatives for rock fall mitigation practices are discussed. Difficulties on construction works are discussed in this paper with few examples.

INTRODUCTION

The danger associated with the rock slopes is the fall of loose rocks and boulders from the face of slopes. Rockfalls are considered as common type of fast-moving landslide and they represent a major hazard in mountain areas worldwide (Varnes 1978, Whalley 1984, Flageollet and Weber 1996). Varnes (1978) defined rockfall as a fragment of rock or rock block detached or sliding, toppling, or falling along a vertical or subvertical cliff, and proceeds downslope by bouncing and flying along parabolic trajectories or by rolling on debris. It may also begin by the detachment of a more or less coherent block that then disintegrates during the course of movement (Evans and Hungr, 1993).

In rock fall, size of rock fragment or block can range from small cobbles to large boulders having hundreds of cubic meters in size, and travel at speeds ranging from a few to tens of meters per second. The threat posed to life and property loss during such an event is called rock fall hazard and threat always encompassed by rock fall trajectories. The preliminary causes of rock fall are weathering of rock slope, rainfall, slope instability due to discontinuities of joint sets, pore water pressure, earthquakes, etc. Annually, rock fall events cause tremendous damage to life and property in Nepal, especially along highways, settlements and hydropower projects (Dahal et al., 2013). In Nepal, geological factors play vital role for rock fall protection. Discontinuities and the overall structure of the rock mass are the dominant contributors to rockfall. Mainly, discontinuity persistence, orientation, and friction along discontinuities within the rock slope are controlling frequency of rock fall on slopes. Differential weathering, erosion and undercutting are the dominant contributors to rockfall in Siwaliks. Rockfall hazards are serious engineering challenges to infrastructure projects in mountainous terrain of Nepal but little to no progress has been made till date to mitigate such problems either with modern engineering solutions or with low cost technologies.

ROCK FALL PROBLEMS IN NEPAL

Nepal is a mountainous country and most of the infrastructures, settlements and utilities fall in the mountainous region. During construction and expansion of instrastructure such as roads, hydropower, train routes and irrigation, the rock slopes are cut on its natural slope and due to this shear strength of the rock slope gets reduced and thus the risk of rock fall on cut slope always increases.

In Nepal, most of the rock slopes are heavily jointed, weathered and are affected by pore water pressure. During rainfall, the residual soil of the top runs off as debris flow exacerbating the situation with loosening of attachment of jointed rock mass. Also during earthquakes, rock fall events are frequent and cause loss of life and properties in a large scale. Few such incidents are happened in Liping area of Kodari, near to the China-Nepal border, after the Gorkha Earthquake (Dahal, 2015).

There have been many fatal rockfall events in Nepal especially in Siddhababa area of Butwal Tansen Road, Dimuwa of Pokhara-Kusma Road. The problem of rock fall is always high in major roads of Nepal and the number of casualties is continuously increasing year by year. In 2015, during rockfalls in Siddhababa, a huge rock boulder smashed on a jeep and killed two doctors. Similarly, a bus was swept away to the Tinau River by rock fall and debris flow killed many people. Exact number of passengers in the bus was not known. Likewise, in the monsoon of 2016, there was news of road blockades in Narayanghat- Muglin Road with rockfall and debris slide. The penstocks of the Upper Bhotekoshi Hydroelectric Project (36 MW) had been completely damaged by rockfall due the recent Gorkha earthquake (7.6 ML) and is not able to produce the power. Therefore, rock fall events are common problems in Nepal and it has greatly affected all the infrastructures development projects, settlements and utilities with huge economic loss. The problem is very much critical in the present context of recent earthquakes causing

huge damages of life and properties. So, identification of rock fall hazard zones and a detail study of the zones are needed for the long term protection of rock fall saving numbers of life, properties and great economical loss.

CURRENT PRACTICES TO PROTECT FROM ROCK FALL HAZARD

For the protection of the rock fall, landslides, and debris flow following protection measures are currently in practice in Nepal.

- Construction of Retaining Structure
- Gabion wall works
- Cascade drain
- Bioengineering works (Tree and shrub plantation)
- Small fences
- Upslope Catchment drain

Among them, gabion and stone masonry retaining wall are very much common mitigation practices. Such protection systems are good for shallow soil slope failure and erosion protection only and they are not suitable for the rock fall protection systems. The gabion wall cannot dissipate the high impact energy of rock fragments and the failure of such protection measure is common on roadside slopes.

Need of new technology

The current practices applied in Nepal for the rock fall protection systems has not been totally successful for the protection of the rock fall in all the infrastructure development projects, settlement and utilities. The impact of the boulders falling are huge that has torn out and damage the fences. As the boulders fall by rolling and bouncing, protection measure structures used are damaged by hitting and boulders bouncing over the structure have increased the damages in large scale. Also as the rock fall hazard area happens to be in too steep topography, such structure measures could not be adapted easily and it costs high economic loss as well. In addition rock bolting and counter forts are scarcely used in Nepal.

During monsoon, heavy rainfall always washes out the slope protection structures and they serves as only as a temporary measures. Failure of structures increases the damages more and every year new construction of structures will create a great economic loss to the country. Thus for a long-lasting and economical solution; a new technology should be adapted for Nepalese geological conditions which can perform as effective solution for the rock fall protection system. There are various innovative mitigation solutions (Fig. 2) for the rock fall protection that are tested in various laboratories and are found to be suitable for Nepalese rock fall problems.

Rock fall catchment fences are developed to protect infrastructures, utilities, buildings and lives from falling rocks and debris. Typical catchment fences are installed in run-out or deposition zones, close to the elements at risk that they protect. For this purpose, a wide range of tested systems that differ in the maximum energy level (100 KJ – 5000 KJ) and the approved heights (2.5 m – 9.0 m) are available. Fixed rotations systems, as well as systems with retaining ropes are also available. Due to their modular construction, rock fall protection systems can be easily adapted to topographical conditions of Nepal. The small mesh-size of the OMEGA-Net in the various protection systems makes an additional

Fig. 1: Rock fall and blocked of road near Dhunche and Rock fall in Siddhababa Cliff, Butwal-Tansen Road.

Fig. 2: Various rock fall and avalanche protection systems that are available to install in Nepal in these days (Trumer, 2015).

Fig. 3: Location map of selected sites, UBKHEP and Siddhababa area.

layer which in many cases redundant and it helps in the dissipation of high impact energies due to its flexibility. The variable construction methods for the foundation make an optimal adaptation to variable topographical conditions. All the rock fall protection systems now available in Nepal are tested at a test site and approved by independent institutes.

Installation of rock fall protection system in Nepal

Presently two sites in Nepal are selected for installation of rock fall protection system. First site is the Upper Bhotekoshi Hydroelectric Project and other site is Siddhababa area, Butwal-Tansen road (Fig. 3).

Site 1: The Upper Bhotekoshi Hydroelectric Project

The Upper Bhotekoshi Hydroelectric Project UBKHEP is a run-of-the-river power plant in Sindupalchowk District, Nepal approximately 105 kilometers northeast of Kathmandu. The Powerhouse site lies at latitude 27°54'45"N and longitude 85°55'28"E (Fig. 4 and Fig. 5). It was constructed between 1997 and 2000 and power generation started in January 2001. After recent Gorkha earthquake, lots of damage had been observed in the project site. The penstock pipes were hit by the rock fall and were completely damaged. The rocks are highly fractured and major joint dips more than 70 degree on the slope. Thus the project is unable to supply the electric power and is currently on the maintenance phase. Depending upon the source zone and the affected area, a hinged TSC-3000-ZD (Trumer 2015) rock fall protection system of height 5.5 m at top source zone is planned (Fig. 6 and Fig. 7) and is now under construction. In total, four rows, namely row 1 (51 m), row 2 (58 m), row 3 (61.5 m) and row 4 (138.7 m) of about 310 m total in length are planned in the area. The installation is in progress now.

Fig. 4: The rock fall source zone and the rock fall affected area of UBKHEP.

Fig. 5: The working site in four rows for the rock fall protection works.

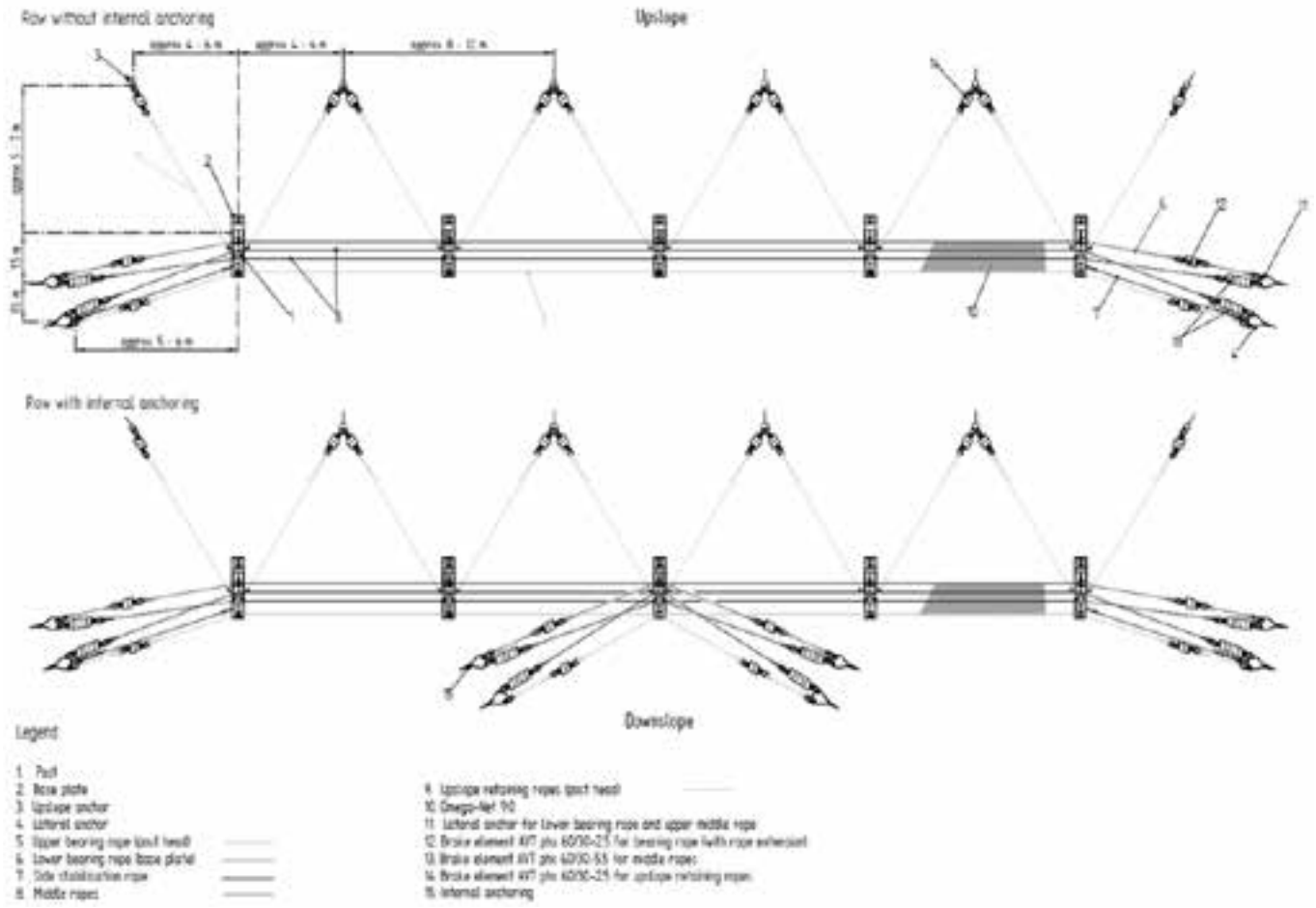

Fig. 6: The hinged systems of rock fall protection with upslope anchor ropes use in the upper rows and left side of penstock of UBKHEP rock fall protection site. The proposed rock fall systems are planning to use in the site can resist the impact energy of 3000 KJ.

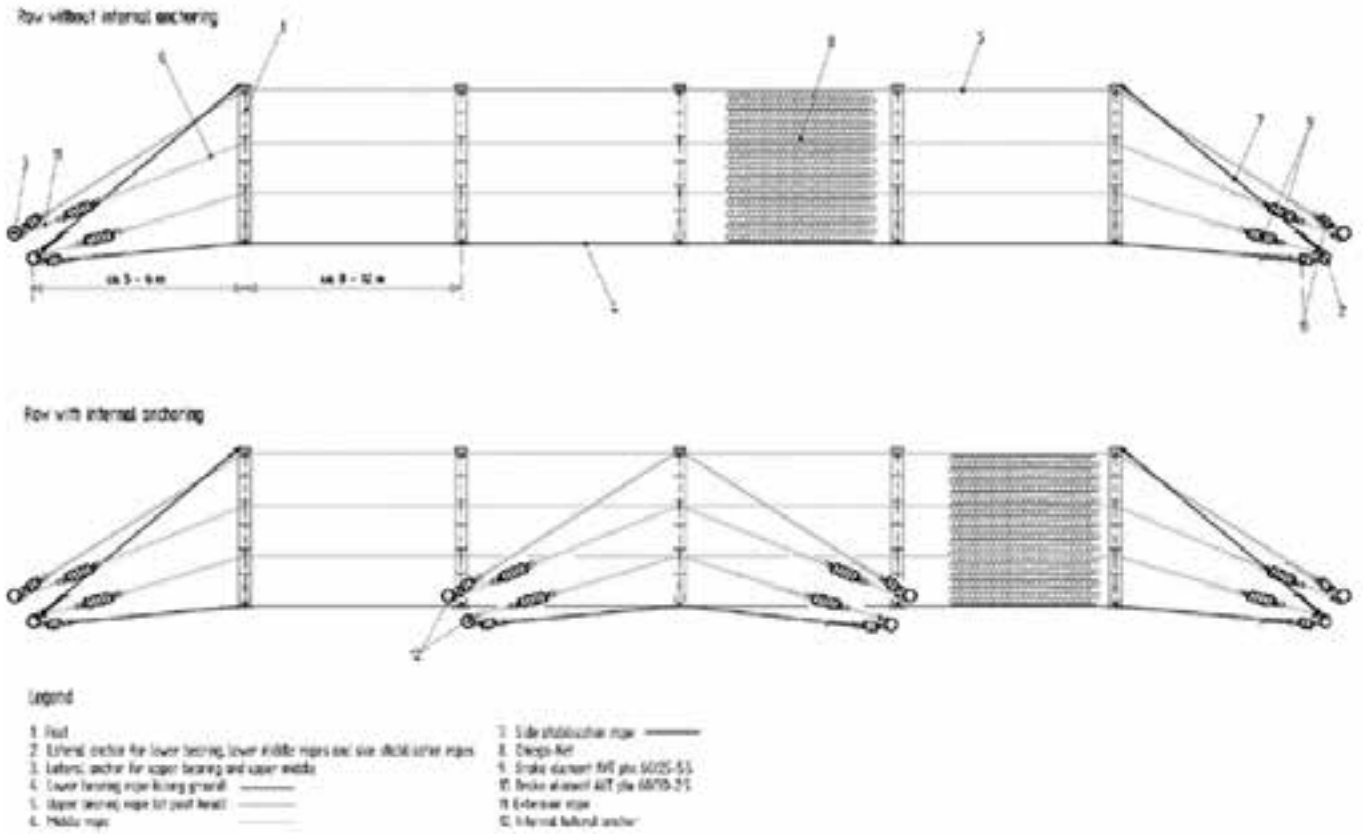

Fig. 7: The rigid rock fall protection systems without upslope anchor ropes those are going use in the right side of the penstock of UB-KHEP. The proposed system in the site can resist the impact energy of 2000 KJ.

Fig. 8: Preparation of construction to sites in the Row 4.

Fig. 9: The operation of the drill machine on scaffolding platform.

The construction work (Fig. 8) is started on the site on April 4 2016. The project duration of the work is for 6 months periods. For the foundation post and upslope anchor hole of 5 m depth, a pneumatic down-the-hole (DTH) drill machine was introduced first time in Nepal to prepare anchor holes on the difficult slope (Fig. 9). The drilling work started from the right side of the row 4. The drill machine needs highly stable platform with high safety precautions. Stable scaffoldings were introduced for the safe drilling at an angle of 45 and 90 degree for the foundation post and 10 to 15 degree for the upslope anchor point. The drilling works on such steep slope (about 45 to 60 degree with the horizontal surface) has been the most challenging works to be performed (Fig. 10). The need of high air pressure and stable work platform and highly skilled manpower is most important to perform the work smoothly. The rate of drilling on hard rock was found to be 10 minutes per 1 m depth. Till date the drilling works of row 4 foundation anchor posts and upslope anchor points on the rock surface has been completed already. Total number of drill holes completed is 57 out of 207 on the upper rows.

Fig. 10: Challenging drilling works with scaffolds on steep slope.

The rock fall is continuous on the site and more frequent on the gully. High rock falls could be seen on the rainy days along with the debris flow through the gullies.

Site 2: The Siddhababa area, Butwal-Tansen Road

The Siddhababa area that covers almost 2 km of the Siddhartha Highway is the most problematic site for rock fall and slope instability In Nepal. The construction of the Siddhartha Highway was completed in 1971 with the financial aid of the Indian Government to connect the Indian boarder town Sunauli with the touristic city Pokhara. This 180 km long highway passes through relentless bends and curves making it one of the adventurous roads of Nepal. Siddhartha Highway is also one of the busy highways of Nepal with daily traffic volume in Siddhababa area exceeding 3000 vehicles per day. Such high traffic volume drastically increases the vulnerability of the area because the probability of a vehicle getting hit by a falling rock increases with the increase in traffic volume. It is estimated that in average around 60 rock fall events happen in this area every year. Rock fall events have been reported even during dry seasons. In average, 10 people get killed and around 20 people get injured from rock fall events in this area every year. Apart from the losses of life and property, every year the highway gets blocked for long periods due to the fallen rocks and debris, which contributes to further socio-economic losses. Hence there is a need of immediate implementation of rock fall and debris flow mitigation measures in the Siddhababa area.

Based on the field visit the whole section of Siddhababa is prone to rock fall. It would be good if we could cover the whole overhang section with the wire mesh and on the risky streams from debris barriers. Initially, most critical section is identified and rock fall protection system is designed. During the site selection, priority has given to the number of human casualties on the road due to rock fall (Fig. 11). Department of Roads (DoR) also prioritizes these sections as most problematic one.

CONCLUDING REMARKS

This paper describes and discusses new technologies for rock fall mitigation in the Nepalese slopes. It highlights their importance and installation process. A customized system of DTH drill system is prepared and is now implementing on very steep and challenging slopes for anchor holes. Talking about new technologies is quite easy but implementation is very challenging due to limited resources and limited machineries available in Nepal.

Fig. 11: Siddhababa area and schematic illustration of the rock fall protection system, B8 is proposed site for wire mesh and B9 for rock fall protection barrier.

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Conceptual overview of community-based landslide risk reduction

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ABSTRACT

Communities in mountain hill-slopes are living in the old landslides or close proximity to recent landslides, thus, landslides pose a physical and environmental threat to vulnerable communities. In risk reduction strategies, concept of community-based approach is becoming the growing interest that engages communities and helps people work together to minimize landslide risk. The community people (entire community, particularly women, young people, and all livelihood groups etc.) who participate in risk reduction process can learn scientific techniques from the experts and replicate the procedure by themselves i.e. it is direct knowledge transfer mechanism to communities and also creates ownership of local communities and increases the chances of successful implementation. The technique which uses locally available resources is popular in community level and suitable reduction measures are diversion of surface water, tension crack sealing, bamboo sub-drainage etc.

Keywords: Landslide, community, risk reduction.

INTRODUCTION

The frequent event of landslides in the mountainous terrain poses a severe threat to lives, livelihoods, and development gains especially in the developing countries. A better concept is indispensable through the assessment tools and techniques to identify the actions for reducing the vulnerability of communities facing landslides risk. Among the various types of landslide risk reduction approaches, community-based risk reduction is increasing concern nowadays that engages communities and helps people work together to minimize risk in the landslide affected areas. The community based landslide risk assessment approach puts communities at the centre point, providing local people with opportunities to participate in identifying and evaluating risk, as well as in formulating and implementing measures to reduce risk. The engagement of local communities and their ownership of the process increases the chances of successful adoption and implementation. This approach eventually empowers communities to better cope with the adverse effects of disaster and must formulate the scientific technique that can be easily understood by the communities.

RISK REDUCTION APPROACH

A community-based approach aims to reduce their socially constructed vulnerability by involving communities as active participants. There is also a broadening consensus that it is cost-effective to train and educate communities about risks they face, provide them access to resources and knowledge, and to develop community-based preparedness and mitigation programs (World Bank 2007). Identifying the most effective means for engaging community can provide the best way to adopt good slope management practices. The community-based landslide risk mapping is a two-way learning process. Engaging with individuals in the community enables the synthesis of their detailed local knowledge of the slope with scientific and engineering knowledge of slope processes (Anderson and Holcombe, 2013). In this process, community awareness of slope processes and of good and bad slope manage-ment practices is also likely to be raised.

Landslide risk reduction measures must have a scientific basis. A scientific base that, combined with a community base, delivers the evidence base for landslide risk reduction (Fig. 1). In developing the scientific foundation for landslide risk reduction in communities, it is important to develop partnerships with the community, and establish good technical and managerial practices with respect to landslide risk. According to Anderson and Holcombe (2013), the four general steps can be followed in community-based landslide risk reduction.

Understanding community risk perception: Community representatives can greatly assist in providing information on slope features relating to landslide hazard. Community information should be assessed and moderated through a number of mechanisms prior to interventions being made. To ensure that the interests of all groups within the community are heard and that information is triangulated using a variety of participatory activities (Anderson and Holcombe, 2013).

Starting to engage the community: It is a process of understanding of landslide hazard causes and solutions by communities. The engagement of communities ensures the ownership solution (Fig. 2) and is the starting point of integrating scientific base and community base.

Walk-through with community members: Gaining

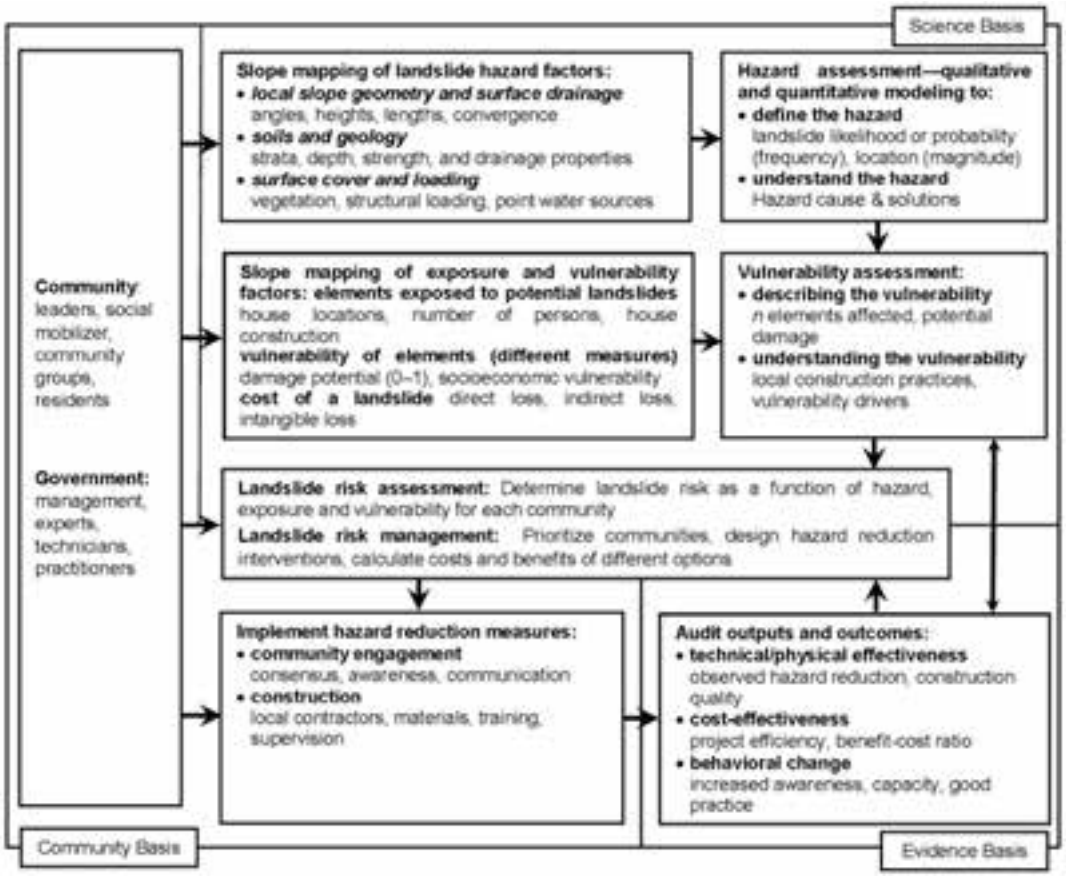

Fig. 1: Integrating science, communities, and evidence (Anderson and Holcombe, 2013).

Fig. 2: Engaging community people in landslide risk reduction.

acceptance within communities is a very important process that involves the identification of community members to start by showing the community and hillside, and point out any known areas of landslides. Selected community member (e.g. social mobilizer) should be familiar with its layout and history, and who are respected and trusted by other community members (Anderson and Holcombe, 2013). A good starting is to ask community leaders or leaders of community based organizations whom they would recommend as a guide.

Hold formal meetings with community: Community meetings should take place at several stages (a) before landslidemapping process begins to raise awareness and what to expect (b) after the initial period of conversations. Community meetings provide an opportunity for everyone to express their views, for information to be shared, and for community dynamics to be appreciated more comprehensively (Anderson and Holcombe, 2013). The meeting should be attended by elected representatives, community representatives, media personnel, and landslide vulnerable communities.

Utilization of locally available resources is the important aspect in community-based approach and community people are involved while applying the landslide risk reduction measures. Among different types measures, some commonly implemented techniques in community level are described as:

Tension crack sealing: Tension cracks at top of a slope are a indicator of the initiation of a new failure or reactivation of a pre-existing one. It is common for pre-existing landslides to reactivate as a result of rainfall or snowmelt, earthquakes or the activities of man. The main reason of further aggravation of slides is due to rise in pore water pressure by the preferential pathways of infiltrating water to the depths through the tension cracks (van Asch and Buma, 1996; Matsuura et al., 2008). Community people can identify the tension cracks in landslide prone areas and seal them appropriately. The crack sealing techniques involves removing of unstable materials from tension crack, digging ditch (about 2 feet depth, 1 feet width) along the crack and sealing crack by compacting very fine soil (clayey soil which acts as impermeable layer to prevent water infiltration) and finally putting turf at the top of crack. The crack sealing is simple (community can learn without difficulty) but useful technique to control landslides. Thus, tension crack sealing of landslide is one of the most commonly applied community-based landslide risk reduction technique.

Diversion channel: Surface water is one of key issue in controlling the landslide because unmanaged surface water increases the risk of landslides; already vulnerable communities are being made more vulnerable. Evidences showed that simple retaining wall structures do not provide an appropriate landslide risk reduction approach, it is more appropriate to consider the impact on slope stability of reducing the surface water infiltration through the management of all forms of slope water (Anderson et al., 2011). Diversion channel can be used to divert the surface water entering into the landslide prone area and such technique is familiar to community people.

Bamboo sub-drainage: Bamboo is commonly available plant to the community which can be inserted to lower water table in landslides area. In this way, the bamboo function as horizontal drain and serves the benefit of gravity outlets. The horizontal drains are good for early treatment to intercept subsurface seepage at side-hill (Hopkins et al., 1988). The bamboo sub-drainage is the economic means of removing groundwater by community people since pore water pressure is the principal cause in most of the landslides.

CONCLUDING REMARKS

Conceptual overview of community-based landslide risk reduction approach indicated that the engagement of local communities ensure the ownership and sustainability. The approach eventually empowers communities to better cope with landslide risk and it is also the component of capacity building to raise awareness and change perceptions of people for risk mitigation measures. Diversion of surface water, tension crack sealing, bamboo sub-drainage etc. are popular risk reduction measures in community level because the techniques use locally available resources and workmanship.

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The importance of springshed approach for the conservation of springs in Nepal Himalaya

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ABSTRACT

Many springs in Nepal Himalaya are drying rapidly during recent years and no any systematic approach is developed to revive drying springs in the Himalaya. Therefore, this article present the springshed (muladhar) concept to address the growing problem of drying springs. It also highlights how the springshed concept is different than the traditional watershed concept with the methodological procedure of developing springshed approach. The springshed approach helps to ensure water security of many hill communities living scattered settlements across Nepal Himalaya and also for growing urban areas in middle hill regions of Nepal Himalaya depending on spring water for various purposes.

Keywords: Springs, springshed, spring revival, water security, Nepal Himalaya,

INTRODUCTION

The utilization of tapping of spring water is an ancient art, which provide an easy access to water to human settlements. Many ancient cities were often situated near large springs and cities without a reliable water supply were massively destroyed or abandoned because they could not survive the sieges (Kresic and Stevanovic, 2010). Natural springs are main sources of freshwater in many mountainous regions. In Himalayan region, most of the people are depending on spring water for drinking, households' uses and livestock's. Therefore, spring water is the main source of water providing life to people in the mountain region especially in the Himalaya.

Not only this spring water is only the source of water in many non-snowfed watersheds that keep many streams and river alive during dry season, when there is no monsoonal precipitation, especially during winter season. The main settlements and growing cities that are located in middle hill region of Nepal are primarily depends on spring water to fulfill their water demands for drinking. Though, there is a huge importance of spring water for many purposes but springs conservation and their management is very least focused from government, non-government and private organizations. Many of the organizations are only focused on tapping springs sources and building water supply infrastructures.

The type and behavior of spring's sources are poorly understood. Therefore, there are many examples where water supply infrastructures and their investment became not very successful because spring sources of many project dried after a few years of completion of water supply systems. Nepal Himalaya can be divided into five different tectonic regions: Terai zone, Siwalik zone (Sub-Himalaya zone), Lesser Himalaya zone, Higher Himalaya zone and Trans-Himalayan zone (Gansser, 1964). Most of the people are living in Terai, Sub-Himalaya and Lesser Himalaya region and most of the people in all three regions depend mainly on groundwater for their drinking and other household uses. In Terai zone, groundwater is collected from drilled wells or dug wells whereas in hilly regions groundwater is available in a form of spring water. In some region of Lesser Himalaya and the Sub-Himalaya, stream water is also used for drinking and other households purposes, which are also fed by springs in many non-snowfed watersheds.

THE SPRINGSHED ('MULADHAR' in Nepali) CONCEPT

There are different government institutions that are doing watershed conservation practices such as the Department of Soil Conservation and Watershed Management (DSCWM), Department of Water Induced Disaster Prevention (DWIDP) and also Department of Environment (DoE). These institutions are mainly focusing on soil conservation measures within a targeted watershed by planting different tree species with or without engineering structures. While doing watershed conservation, water sources within a watershed are also protected constructing concrete structures and making an easy way of fetching or collecting water from spring sources. This type of concrete structures protects spring against source contamination but these types of activities do not play role to conservation of springs. Therefore, the present existing practices of watershed conservations adapted by different government and non-government institutions are not sufficient for conservation of springs in Himalaya region. Therefore, it is urgent now to apply the springshed concept for conserving

and management of springs in Nepal Himalaya. A conceptual layout of the springsehd is shown in Figure 1.

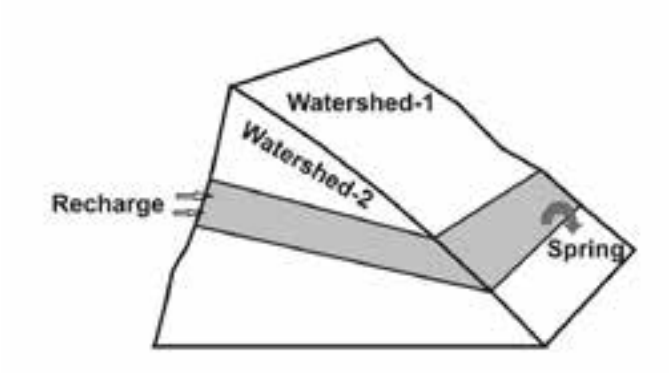

Fig. 1: A conceptual layout of the springshed showing how it differs from a watershed. The grey color in the layout indicates an inclined rock stratum.

The springshed concept lies in a fundamental understanding that surface water divide and groundwater divide are two different concepts and we also need to consider beyond a watershed when it comes to cover a springshed approach (Rijal, 2015). This article explains below why springshed concept is required and how this springshed approach is used for the conservation and management of springs in the hilly regions.

WHY SPRINGSHED APPROACH IS REQUIRED

The traditional concept of watershed (Jaladhar in Nepali language) and its currently existing practices for watershed conservation is not completely address the problem of spring conservation and management. Therefore, a concept of springshed ('muladhar' in Nepali) is based on the fundamental differences that surface water divide and groundwater divide do not fully corresponds each other and the concept of ridge to valley approach that is taken into watershed framework cannot fully address the area of springshed. That means we need to consider groundwater flow systems and valley to valley approach when it comes to adapting the concept of springshed for the conservation and management of springs. That means springs are a type of groundwater systems and it requires considering the anagement of groundwater systems which is also mostly not taken into account when considering watershed practices. Therefore, when it comes to spring conservation implementing springshed approach, the participatory watershed management approach is also requisite to replace by participatory groundwater management approach forming various types of users groups or community groups.

There are some studies in India such as in Sikkim, Maharastra and Andra Pradesh (ACWADAM, 2005, 2007, 2009). In the southern Sikkim, many springs inventory were done and springshed concept was implemented for the conservation of springs of this area under Sikkim Dhara Bikash program (Sikkimsprings.org). The conservation and management of springs of this area was not successful using traditional watershed approach but became successful after adapting springshed approach.

THE METHODOLOGICAL APPROACH

Springhead approach basically means conservation and management of springs for a long sustainability of spring's water in order to increase water security of many people residing in hilly regions. It combines all three aspects including scientific part of understanding springs hydrogeology, groundwater management and community participation. There are a few works they used spring shed approach such as ACWADAM (2011), ICIMOD (2015). According to springshed approache adapted by ACWADAM (2011), it mentioned developing a understanding hydrogeological conditions including mountain aquifer systems, springs data collection, identification of spring types, setting up spring monitoring systems , planning of treatment measures in the recharge area and community participation for spring conservation. Similarly, a seven-step approach is also mentioned by ICIMOD (2015) which combines mapping, monitoring, governing systems, forming hydrogeological layouts, classifications, developing management protocols of springs.

Whatever steps are mentioned in the previous studies, the main steps under springshed aproaches can be grouped into the following three major steps covering scientific understanding of spring systems as well as conservation and management of involving water users of the area.

1. **Hydrogeological mapping of an area.**

All the geological, hydrological and geomorphological features from an area of interest are needed to gather for the preparation of the hydrogeological mapping of the area.

2. **Preparation of conceptual layout of the area for springshed delineation.**

After the completion of hydrogeological mapping of the area, various layouts are needed to understand hydrogeological settings of the area then a conceptual layout for a particular springshed can be prepared.

3. **Implementation of springshed conservation and management interventions.**

Once conceptual layouts are prepared from the step two, springshed area are marked demarcating recharge areas, conservation areas and management area. Then, field intervention activities for spring recharge, conservation and management measures can be selected and implemented in the springshed areas by using participatory groundwater management practices.

DISCUSSIONS AND CONCLUSIONS

Since, there is a very high dependency of village communities and urban residents on spring water in Nepal Himalaya for drinking, livestock and other households uses, it is important to ensure water security of millions of people living in these areas. An increasing impact of climate change

and climate variability has led to drying of many springs whereas many large springs are yielding a very low water discharge, especially during dry seasons.

Applying a springshed concept yield a better result for spring conservation than watershed approach but this needs a systematic approach first for delineation of springshed area and then a systematic approach for implementing conservation and management of springsheds. Not only this, springshed management play also crucial role to for a longer term conservation of many wetlands in hilly regions of Nepal Himalaya, which are feeding by several springs systems in many Himalayan regions (Rijal, 2016).

In the conservation measures, it is important to understand spring types and their seasonal behavior. That means spring water quantity and quality are important parameters to understand spring seasonal behavior and how they are related with changing impact of monsoonal variability and seasonality. Increasing groundwater recharge for conservation and long term sustainability of spring water by increasing recharge options play a significant role by creating artificial recharge options. Managed underground storage can be accomplished in ways that can augment reliable water supplies, often inexpensively (National Research Council, 2008). Since, spring water is a type of groundwater system, which has the capacity to buffer extreme hydrologic events because recharge is not directly tied to precipitation and run-off events (Vaux, 2010).

It is also crucial to gather information on water quality of many springs, which give a fundamental knowledge on water quality related to human health or status of several chemical parameters on spring water. Not only this, determining the origin of groundwater chemistry is crucial for effective water resource management and protection (Jeong, 2001; Moosavirad et al., 2013; Perea and Rodriguez–Rodriguez 2009; Tweed et al. 2005). Additionally, water chemical parameters also help to evaluate the connectivity between different aquifers (Dragon and Gorski, 2015). Back (1966) also used major ions as natural tracers as a common method for identifying flow paths in aquifers. Land use and land cover also impacts on spring water quality as mentioned by Cohen (2008).

There are several methods of implementing intervention options for conservation and management of springs separating artificial recharge in recharge zones and conservation zones of springsheds after clearly understanding of springshed approach as mentioned in the methodological section of this article. However, Shah (2009) emphasized that not just the importance of local schemes of groundwater management but the need for innovative management schemes which relay on ancillary variables to regulate and manage groundwater (Shah, 2009).

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The Melamchi Water Supply Project

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ABSTRACT

The Melamchi Water Supply Project (MWSP) is being implemented by the Government of Nepal with objectives to
- alleviate the chronic shortage of water in Kathmandu Valley on a sustainable and long term basis
- improve the health and well-being of the people in the Valley.

The project consists of the headworks and a diversion tunnel mainly in the Melamchi valley, except for the last 5 km which is in the Kathmandu valley and water purification facilities in Kathmandu Valley. The project works includes from the intake at chainage 0.0 to the Sundarijal portal at chainage 25.986km. The tunnel is being excavated from adits at Ambathan, Gyalthum, Sindhu and Sundarijal Out Fall. The planned capacity of the tunnel is 6m3/s.

The main diversion tunnel is 26 km long with a cross-sectional area of 12.7 m2. The tunnel intake is at an elevation of about 1416m and the outlet is about 1,408 m. Most of the tunnel length is expected to be unlined generally with only shotcrete throughout, but with considerations for selective tunnel lining in sections with weak rock formation. The tunnel excavation is done by drill and blast techniques. The ground conditions are mainly gneiss with mica schist and laminated quartzite of the Higher Himalayan sequence of the Nepal Himalayas. The Gneiss is generally moderately weathered and laminated quartzites are present in parallel to the foliation of the gneiss and the rock is in some places faulted with zones of gauge. The headworks are located within the gorge below Ghwakan, just upstream of the confluence of Melamchi River and Ribarma Khola. The main structure at the headwork consists of the diversion weir, river-training structures, intake structure, headworks diversion tunnel and sediment exclusion basin. A gravity concrete weir dam 5 to 7 m high with an indicated crest at El. 1,425 m will be built across the Melamchi River. The control system and the sediment exclusion basin have a design capacity of 6m3/s. The dual sediment exclusion basins have a total length of 80 m. This paper will describe the actual construction of the project, the challenges of the contract and the site conditions and how they are being overcome, and how finally the long awaited promise of a water supply for the people of Kathmandu is being achieved.

INTRODUCTION

The Melamchi Water Supply Project (MWSP) is the long awaited dream of the people of Kathmandu to receive drinking water from the Melamchi River. There are over 2 million people in Kathmandu with a current water consumption of 180 million litres per day (MLD). Currently this is being supplied by tankers supplying water from various water sources tapped by private agencies, but, these existing water sources are drying up due to the dense population, construction works and climate change. At present these can only supply 140 MLD during the rainy season and 90 MLD during the dry season. The Melamchi Water Supply Project (MWSP) is considered to be the most viable long-term alternative to ease the chronic water shortage in the Kathmandu valley and will deliver 170 MLD of water.

The project has been divided into two parts, the first part (Melamchi Sub Project-1) is the construction of the 26 km. of diversion tunnel from Ribarma Melamchi Khola in Shindhupalchowk district to Sudarijal of Kathmandu district. The second part (Melamchi Sub Project-2) is the establishment of infrastructure and augmentation for the conveyance of the water, and the operation and management for equitable distribution of the water to all citizens of the Kathmandu Valley. This paper will address only part 1, the construction of the tunnel and associated headworks.

HISTORY

Since 1973, the Government has explored alternatives to address the water supply problem, and in 1988 Binnie and Partners of the United Kingdom identified the Melamchi Valley as the best technical option. In 1990, Stanley and Associates of Canada made a preliminary environmental assessment, and in 1992 the Snowy Mountains Engineering Corporation of Australia carried out a full feasibility study, and confirmed the Melamchi Valley as the best alternative technically, environmentally, socially, and economically. The project as such was conceived in 1996 when a Bankable Feasibility Study was carried out which was later updated in 1999 by BPC Hydroconsult and Nordplan from Norway.

Pöyry together with Hifab International and its Nepalese partner Multi Disciplinary Consultants were awarded

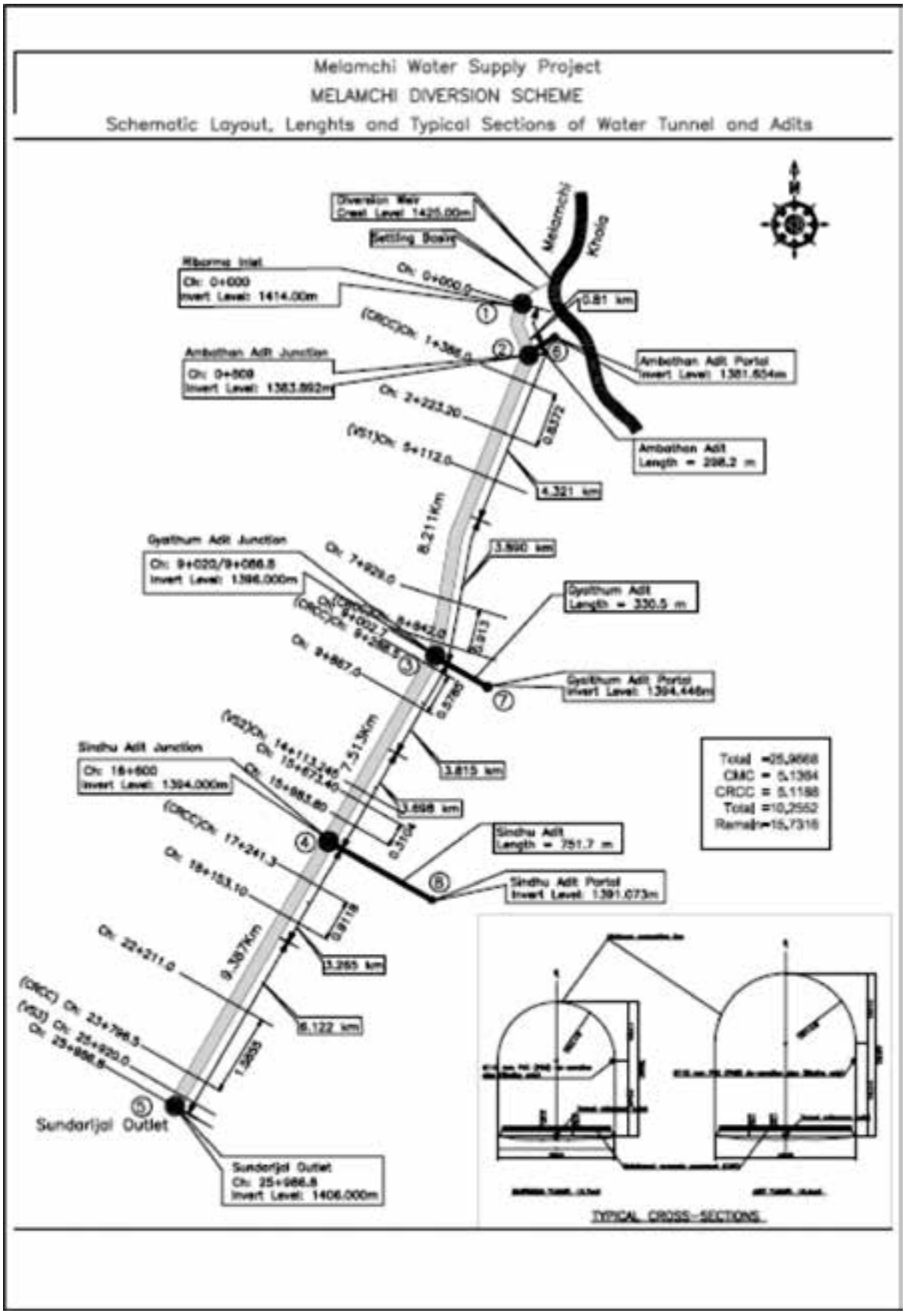

Fig. 1: Schematic layout of the Melamchi water supply project.

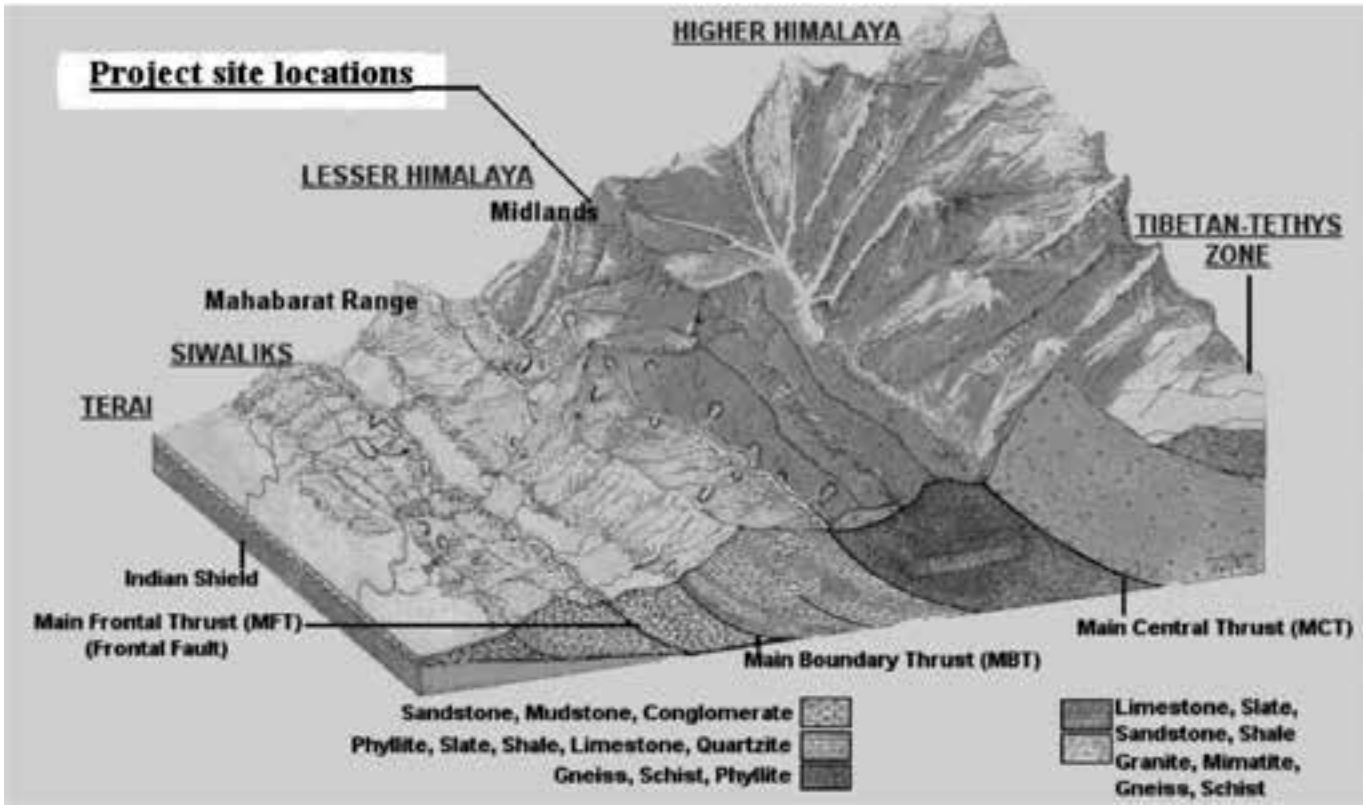

Fig. 2: Regional geology

consultancy contract in 2008, comprising design and construction supervision services for the headworks and water diversion tunnel.

The first contract for construction of headworks and tunnel was awarded on 19th February 2009 to China Railway 15 Bureau Group with intended completion date of 2nd September 2013. Actual physical works started in April 2010. But due to the unsatisfactory performance of the Contractor the contract was terminated on 25 September 2012. In December 2012, the Nepal government floated a fresh tender for the headworks and diversion tunnel construction.

In 2013 a new contract was established with Co-operativa Muratori and Cementisti di Ravenna (CMC) worth about US$700 mililion. CMC took possession of the site in October 2013. The tunnel excavation at Ambathan and the construction of the headworks is being carried out by a subcontractor, Megatech High Himalaya United Builders JV, which is a local joint venture. The project is being sponsored by the Asian Development Bank (ADB).

THE PROJECT

The general location and basic layout of the MWSP has been set since the late 1980s due to the relative elevations of the Melamchi and Kathmandu valleys and by local topographical features within the Kathmandu Valley. The main diversion tunnel is 26 kilometers (km) long with a cross-sectional area of 12.7 m^2. The tunnel intake is at an elevation of about 1,416 m and the outlet is about 1,408 m. Access to the tunnel is via adits at Ambathan, Gyalthum and Sindhu, and the outlet portal at Sundarijal. All access roads into Ambathan (2 km), Gyalthum (5 km), Sindhu (15.3 km), and Sundarijal (1.8 km) were built prior to commencement of tunnelling.

The headworks and intake structure consists of the diversion weir 5 to 7 m high with an indicated crest at El. 1,425 m built across the Melamchi River. This weir feeds the water into the control system and the dual sediment exclusion basins which have a total length of 80 m. From the sedimentation exclusion basins the water is fed into the main tunnel located in the rock face-running north south near the right bank of the Ribarma Khola near the confluence with the Melamchi River. In order to build the diversion weir a tunnel is required to divert the water around this section of the river to enable construction to proceed. An upstream dam is required to divert the water into this diversion tunnel. To protect the civil structures from potential future flash floods during monsoon, river training and diversion works are also required for the Rabarma Khola.

During operation, the headworks will divert 2.8 m3/sec of water from the Melamchi River. During the dry season from February to April, approximately 75 percent of the Melamchi River flow will be diverted. During the rest of the year a much larger percentage of environmental flows are retained in the Melamchi. This is particularly important for the May-June and October-November periods when fish are migrating. The impact of flow reduction in the Melamchi will be evident for only a short distance downstream as there are many rivulets flowing into the river basin. For the succeeding phases when diversion to the Kathmandu Valley reaches 6 m3/sec, additional water will be abstracted from the Yangri and Larke rivers.

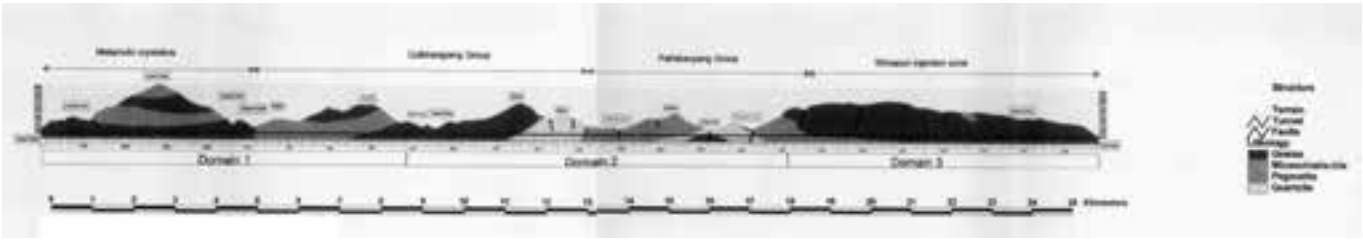

Fig. 3: Geological longitudinal section of tunnel.

Upstream of Timbu, the Melamchi River elevation rises abruptly by more than 300 m within 3 to 4 km. This provides an opportunity for a dual-purpose water supply/hydropower project, and a 25 megawatt hydropower plant was incorporated in the MWSP plans as proposed in December 1999. However, inclusion of this power source in the national expansion plans would have deferred the next project by no more than six weeks, and most energy would have been generated in the wet season when NEA has many alternative sources of power. A serious review of this component was undertaken from February to April 2000, and resulted in elimination of the hydropower component.

GEOLOGY

The project area lies in the Gosaikunda Tectonic Bridge, a zone where the thrusted rock mass extends right up to the root zone without interruption (Hagen 1969). Obviously, the rock mass of the project area represent highly sheared and tectonised part of the upper thrusted sequences (Kathmandu Complex - Shivapuri injection gneiss zone, Stocklin, 1980) above the major thrust Plain, the Main Central Thrust. This thrust separates the meta-sedimentary sequence of the para-autochthonous Lesser Himalaya from the allocthonous rock masses of crystalline nature of the Central crystalline element of Higher Himalaya. A number of longitudinal thrust faults have been mapped in the project area along which rocks have been described as sheared and tectonised (SMEC, 1992).

The rocks are largely metamorphic consisting of gneisses, migmatites, schists, pegmatites and quartzites. Based on the metamorphic characteristics the rocks in the Melamchi Valley have been grouped into following groups: Gulbhanjyang Group, Talamarang Quartzites, Patibhanjyang Mica Schist Group, Shivapuri Group. Most of the rocks are strongly foliated and hence anisotropic in strength. The Gulbhanjyang Group rocks extend up to the proposed intake and consist of augen gneiss, quartzitic gneiss, migmatitic schist and gneisses. The Talamarang Quartzites consist of sericite-quartzite. The Patibhanjyang Zone is separated on the basis of the dominance of micaceous schist. The Shivapuri Gneiss Zone in the extreme south of the area is a combination of various kinds of gneisses including augen – gneiss, banded gneiss and granitic gneiss with pegmatite.

Four major faults have been mapped across the tunnel alignment in the Melamchi Valley namely: Patibhanjyang Fault, Talamarang Fault, Gyalthum Fault and Gohare Fault. A fault has been inferred at the Ribal Khola area also. Gyalthum Fault has been suspected to bifurcate and extended to the Gulbhanjyang saddle and Jogindanda ridge.

MAIN TUNNEL CONSTRUCTION

The ground conditions are mainly gneiss with mica schist and laminated quartzite. The Gneiss is generally moderately weathered and laminated quartzites are present in parallel to the foliation of the gneiss and the rock is in some places faulted with zones of gauge.

There are essentially five access points for tunnel construction. Some 6 km of the diversion tunnel excavation will be undertaken from the tunnel outlet portal from Sundarijal, there is also access via the inlet portal at Ambathan. In between there are three adits at Ambathan, Gyalthum and Sindhu which enable the tunnel to be excavated both upstream and downstream.Ambathan Adit is located on the Right Bank of the Melamchi river at an elevation of about 1,400 m and is approximately 298 m long and has a cross-sectional area of 16m2. A total of 5,160 m of diversion tunnel length is proposed for excavation from this adit (809 m in the upstream section and 4,351 m in the downstream section).

Gyalthum Adit lies on the left bank of Gyalthum river at an elevation of about 1,400 m. This adit is approximately 330m long with a cross-sectional area of 12 m2. It meets the main diversion tunnel at approximate chainage 9.1 km. A total of 7,674 m of tunnel length is proposed for excavation from this adit (about 3,896 m upstream section and 3,778 m in the downstream section).

Sindhu Adit is located on the right bank of Sindhu Khola at an elevation of about 1,400 m. The adit length is about 630 m and has a cross-sectional area of 12 m^2. The meeting junction with the main diversion tunnel is at approximate chainage 17 km. A total of 7,242 m length of diversion tunnel is proposed for excavation from this adit (3,765 m upstream section and 3,477 m downstream section).

The tunnel excavation is by drill and blast techniques. A strict accounting system is in place for explosives. Explosives are stocked in bunkers with 24-hour security by the Nepal Army. A geologist determines the blast size and amount of explosive required and the required explosives are escorted to site by the Army. On completion of charging a full account of the explosives used is presented to the army representative with any unused explosives returned to the bunker.

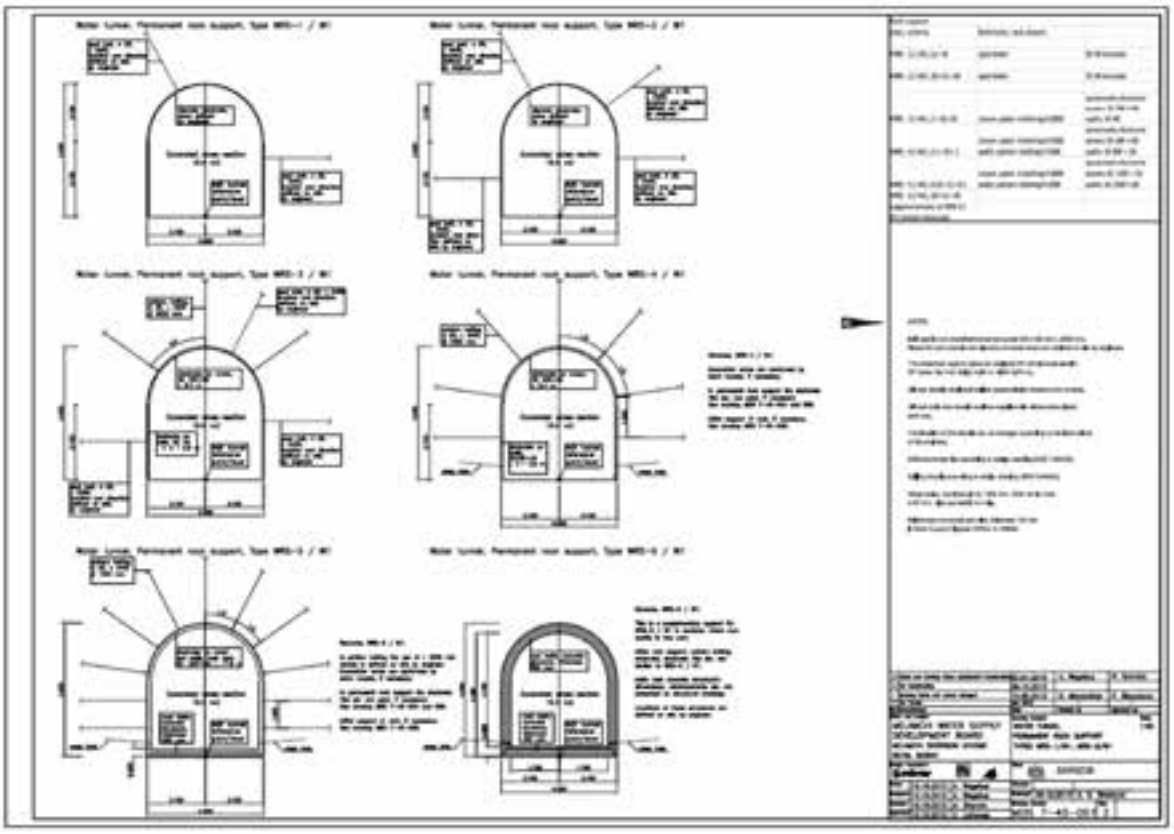

Fig. 4: Tunnel support classes.

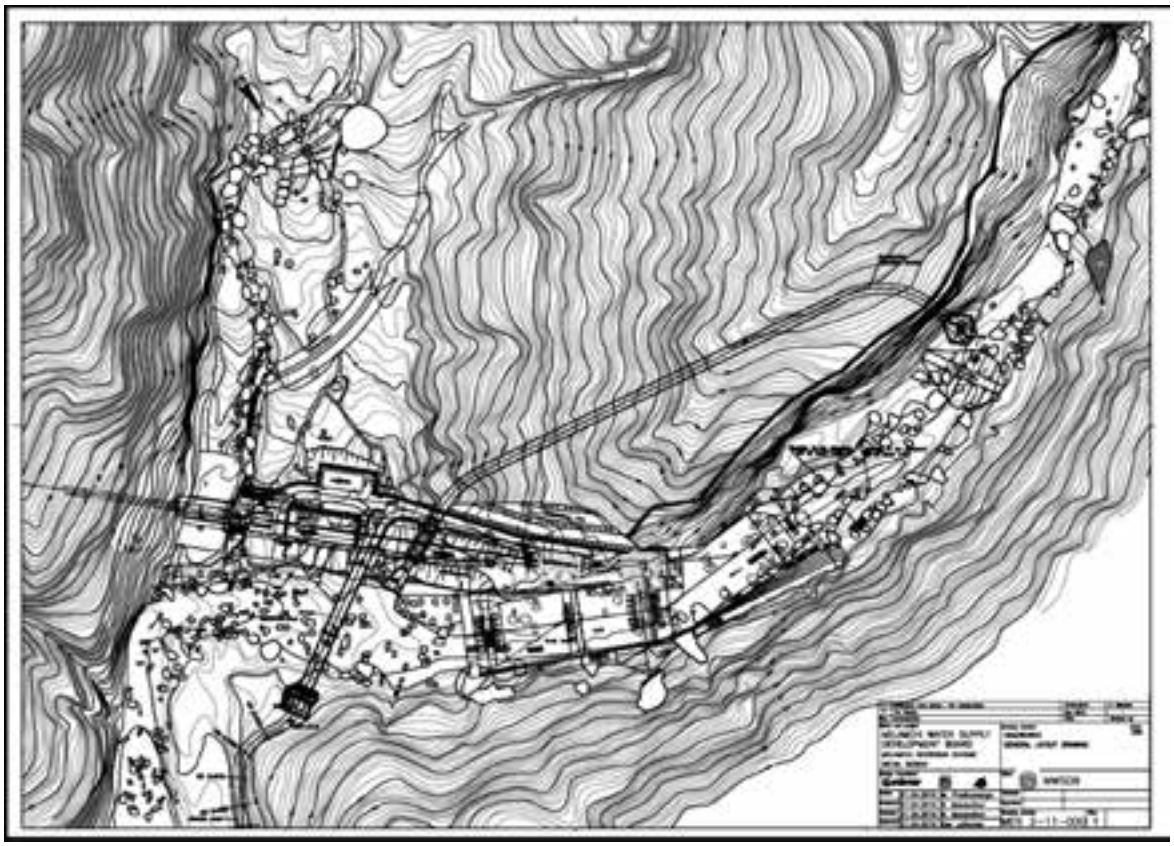

Fig. 5: Headworks layout and plan.

Drilling is carried out by Atals Copco L2D twin boom jumbos. With about 80 blastholes used and a charge rate of about 3.5kg/m3. Explosives are imported from Orica India with 32mm diameter and 40mm diameter Powergel emulsion being used. Additional material is provided by the Nepal Army to supplement supplies from India. The design of the tunnel support is based on the Q system (Barton et al., 1974) and provides six different support types based on rock quality. The initial or safety support is the responsibility of the contractor and CMC have adapted these designs to enable the use of lattice girders in the lower rock classes WRS IV, V and VI as a means to provide more immediate support to these weaker rock masses. Shotcrete is applied by means of CIFA robotic shotcrete pumps. During July and August 2014 there was a significant shortage of aggregate as the Government enforced environmental laws for the extraction of sands and gravels from the river. As such CMC are now planning to install their own crusher plant for the project. Shotcrete thickness is measured in the tunnel and cubes and beam samples are taken for testing. Rockbolts are fully grouted and tested by "pull tests" to 80% of the yield strength of the steel. Some resin capsules have been used for some temporary bolts.

Problems due to poor rock quality and large inflows of water has been creating difficulties in rock support and shotcreting in particular. To date pre-grouting of the excavation has been carried out and water inflows have been left to drain and observed to diminish with time. Consolidation of very poor rockmass in the fault gauge has been stabilised by pre-consolidation with self-drilling fibreglass bolts. Pre-support of the crown has been achieved by spiling dowels ahead of the face. In such conditions the face is often excavated without blasting and the lattice girders and shotcrete are installed right up to the face. Mucking is carried out by Haggloaders feeding Paus dump trucks. The total volume of spoil from the project is calculated at 460,000 m3. The spoil sites are located near the tunnel adits, and gabion walls prevent the spoil from entering the river. Drainage water discharge from the tunnel is treated on site in sedimentation ponds before being allowed to discharge into the rivers or water bodies.

HEADWORKS

The headworks lies in the lower section of a rocky river gorge with shear and overthrust cliffs in the buffer zone of the Langtang National Park (LNP). The LNP is a designated protected mountain area that protects the watershed and minimizes erosion and sedimentation in the upper half of the Melamchi Valley. The Buffer Zone of the LNP extends down the Melamchi Valley to the Timbu area. This Buffer Zone was declared in 1997. Construction works in the Buffer Zone are dependent on the approval of the warden. In particular cutting of trees in Nepal has many requirements and over 3,000 trees and bushes needed to be cut and removed at the headworks site.

There is extensive evidence of landslide on the left bank of the river at the site of the intake structure whilst the right bank is dominated by a large rock mass. This rock mass is the location for the diversion tunnel but also needs to be excavated to provide the required space for the intake structure. This is being carried out by open cut excavation with an anticipated volume in excess of 60,000 m^3. The excavation is by drill and blast in 10m benches with 4m berms. The benches have a slope of 7:1 and are supported by plain shotcrete and rock dowels with mesh in the more weathered sections. The colluviums slopes above have been stabilised at a slope of about 1:1 with mesh to encourage vegetation to grow to provide a bio-engineering solution.

The diversion tunnel is 211 m long and has a cross section of 12.9 m^2 and a gradient of 8%. The tunnel is excavated by drill and blast using handheld airleg machines. The rock class is predominantly Class III. To enable early excavation of this tunnel during the last monsoon, the tunnel was commenced through an adit about 30m from the outlet.

To protect the civil works from potential flash floods during the monsoon from the Raberma river, a dam and river training works are envisaged. With a cut and cover structure crossing this area allowing the Raberma to flow over the top. Removal of sediments from the intake water is crucial and apart from sand and gravel traps the main sedimentation basin will be what is known as a S4, Serpent Sediment Sluicing System (Stole 1993).

ACCESS ROADS

A study reports as many as 17 landslides in the area (ICIMOD, 1997). Altogether 62 unstable spots are recorded in the vicinity of directly project affected area (IUCN/Metcon, 1999). In the Gyalthum Valley, at least two major landslide areas have been identified. In the Sindhu Valley, there are seven landslide spots. Three of them are active, and four are moderately stabilised (IUCN/Metcon, 1999). Several of the

Table. 1. Rock support classes.

Rock Class	Q Value	Rock Mass Condition	Support type
RS1	Q > 40	Very good	Discrete shotcrete and rockbolts
RS2	10 <Q >40	Good	Discrete shotcrete and rockbolts
RS3	1< Q > 10	Fair	Shotcrete, steel ribs and pattern bolting
RS4	0.1 < Q >1	Poor	Shotcrete, steel ribs and pattern bolting
RS5	0.01 < Q > 0.1	Very Poor	Shotcrete, steel ribs and pattern bolting
RS6	Supplementary to RS5	Very Poor	Reinforced concrete lining

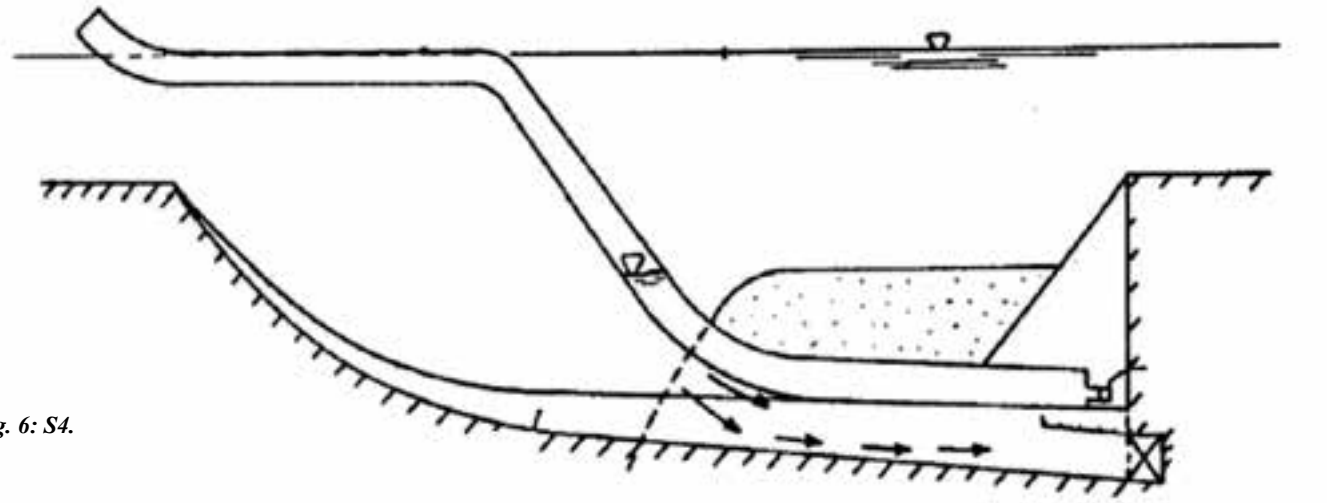

Fig. 6: S4.

existing landslides and rockfalls in the Melamchi and Sindhu Valley are induced by road construction, while in many cases these are due to deforestation, overgrazing and slope cultivation. Particularly during the monsoon these active landslides cause major blockages to the access roads. The contractor is required to maintain the access roads including dust control during the dry season.

OPERATION

During operation it is expected that there is a need to dispose of up to 15,000 m^3 of sludge per year from the sedimentation tank and sand filter backwashing. The sludge will be thickened to a specified minimum water content for disposal.

Consolidated sludge is often used as part of road base material, for reclamation, and for landfill, and the design will incorporate this approach and to adequately and safely dispose of the sludge.

FUTURE DEVELOPMENTS

The Melamchi diversion scheme foresees extension of main diversion tunnel to Yangri River and then Larke River in the next phase of the project development. This includes a Main Diversion Tunnel of about 11 km length from above the Ribarma intake at Melamchi to about one kilometre downstream of Sunchaur at Yangri Khola in the Yangri Valley to divert about 170 Mld of raw water from Yangri Khola and a 1.8 km long tunnel to divert additional 170 Mld of raw water from Larke to the intake at Yangri. The proposed intake lies just outside the National Park boundary at the Larke Khola south west of Hotaribran in the Larke Valley.

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Geospatial technology for site selection for hydropower projects

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ABSTRACT

The survey and site assessment for hydropower projects are carried out for identification of proper site by considering the socio-economic as well as technical points of view. Aerial photography, as well as imagery obtained by remote sensing, using aircraft or spacecraft as platforms, has applicability to various fields including site. Among several reasons for usage of remote sensing data, the capability of representing a larger area of the earth from a perspective view thereby providing a format that facilitates the study of objects and their relationships; provide a 3D view of objects; characteristics of objects not visible to the human eye can be transferred into images and the observer can have permanent record of an object at any moment of time are among its main benefits. In addition, the data is real-time, repetitive and the digital data can be quickly analyzed. The use of geospatial technology has greatly enhanced our capability to appropriately locate the various structures of hydropower project.

INTRODUCTION

The survey and site assessment for hydropower projects are carried out for identification of proper site by considering the socio-economic as well as technical points of view. Aerial photography, as well as imagery obtained by remote sensing, using aircraft or spacecraft has applicability to site selection for hydropower projects. Among several reasons for usage of remote sensing data, the capability of representing a larger area of the earth from a perspective view thereby providing a format that facilitates the study of objects and their relationships; provide a 3D view of objects; characteristics of objects not visible to the human eye can be transferred into images and the observer can have permanent record of an object at any moment of time are among its main benefits. In addition, the data is real-time, repetitive and the digital data can be quickly analyzed.

GIS tools have applications in a number of earth and science disciplines, either because of their capability to visualize results on maps or because of their potentialities in the exploitation of topographic information (e.g. Punys et al., 2011; Shahapure et al., 2010; Brandimarte et al., 2009; Castellarin et al., 2009). It is because of these characteristics that GIS environments have been increasingly used in the assessment of hydropower potential. In fact, with the new generation of GIS software and availability of detailed Digital Elevation Models (DEM), the extraction of the characteristics of the terrain from the DEM, such as river network, river and terrain slopes, hydraulic head have become more and more reliable and easy to access. The availability of free downloadable DEM and open source GIS software can represent a rich resource for the localization and first estimation of hydropower potentialities in emerging countries where the energy demand is expected to highly increase in the next decades (Palomino et al., 2013). Likewise, the remote sensing data are widely used for various development projects (e.g. Pathak, 2015a, 2015b; Chandra et al., 2013). The use of this resource is equally important in case of hydropower project site evaluation and site selection (Calvert et al., 2013; Larentis et al., 2010; Yi et al., 2010; Dudhania et al., 2006).

THE GEOSPATIAL TECHNOLOGY

Use of Remote Sensing Data

Remote sensing refers to acquiring information about a phenomenon, object or surface while at a distance from it. Satellites and spacecraft are used for collecting information about the earth's surface. The satellite image or aerial photograph represents a larger area of the earth from facilitating to study the objects and their relationships (Fig. 1); it can provide a 3-D view of objects; characteristics of objects not visible to the human eye can be transferred into images, it provides a permanent record of an object at any moment of time, and the data can be obtained on real-time and repetitively.

Fig. 1: Synoptic view of the project area with major project structures overlain on aerial photograph. The distribution of the rocks and colluviums are indicated at respective locations.

History of remote sensing

This was an outcome of developments in various technological fields from 1960 onward. During early half of twentieth century, aerial photos were used in military surveys and topographical mapping. Main advantage of aerial photos has been the high spatial resolution with fine details, which is the reason that they are still used for mapping at large scale such as in route surveys, town planning, construction project surveying, cadastral mapping etc. The modern remote sensing system provide satellite images suitable for medium scale mapping used in natural resources surveys and monitoring such as forestry, geology, watershed management etc. However the future generation satellites are going to provide much high resolution images for more versatile applications.

The major achievement of modern remote sensing system against the conventional aerial photography are the use of different and extended portions of the electromagnetic spectrum, development in sensor technology, different platforms for remote sensing (spacecraft, in addition to aircraft), emphasis on the use of spectral information as compared to spatial information, advancement in image processing and enhancement techniques, and automated image analysis in addition to manual interpretation.

Basic principal of remote sensing

Basic principal of remote sensing lies in emission of electromagnetic radiation (EMR) either through the sun (passive remote sensing) or by artificial source (active remote sensing). The transmitted energy reaches the earth surface (some are absorbed and scattered at the atmosphere) to interact through reflection, diffraction and emission. The reflected energy is transmitted back to the atmosphere and reaches to the remote sensor in which data are stored. The sensor data are transmitted to the ground station (in case of satellite image) or brought on the laboratory for preliminary processing, which later is made available either in digital format (satellite imageries) or in printed copy (aerial photograph).

Inherent characteristics of an object are depicted on the image. There are many other factors that greatly influence image quality, the most important being the sensor characteristics, atmospheric effect, resolution of the imaging system and scale, season of the year and time of day, preliminary processing of the image/photographs. An image taken from the air or space is a pictorial presentation of the pattern of a landscape. The pattern is composed of indicators of objects and events that relate to the physical and cultural components of the landscape. It can be said that similar conditions, in similar circumstances and surroundings, reflect similar patterns, and unlike conditions reflect unlike patterns.

Every object has its own unique distribution of reflected, emitted and absorbed radiation. These spectral characteristics can be used to distinguish one object from the other through their differences in terms of shape, size and other physical and chemical properties. The type and amount of information that can be extracted is proportional to the knowledge, skill and experience of the analyst, the methods used for interpretation.

Image Interpretation

Image interpretation is defined as the act of examining images to identify objects and judge their significance. An interpreter studies remotely sensed data and attempts through logical processes to detect, identify, measure and evaluate the significance of environmental and cultural objects, patterns and spatial relationships. It is an information extraction process. An interpreter is therefore a specialist trained in the study of photograph or imagery, in addition to his or her own discipline.

Elements of Image Interpretation

The interpreter must be aware that the same object under different moisture or illumination conditions, and depending on the wavelength of incident energy, may reflect a different amount of light. Since an image represents energy reflected, emitted or transmitted from an object in different parts of the spectrum. For better interpretation of the image, various elements of image interpretation that are important characteristics of the object are considered. These characteristics of objects are their shape, size, tone, pattern, shadow, pattern, texture etc. The natural features and man-made objects can be easily separable with the help of shape of the object. The approximate size of many objects can be judged by comparisons with familiar features (e.g. roads) in the same scene as the length, breadth, height, area and/or volume of an object can be significant. The tonal variation between objects depends on how different objects emit or reflect different wavelengths and intensities of radiant energy. Such differences enable discrimination of many spatial variables. The terms `light', `medium' or `dark' are used to describe variations in tone. Texture is an important image characteristic closely associated with tone in the sense that it is a quality that permits two areas of the same overall tone to be differentiated on the basis of microtonal patterns. Common image textures include smooth, rippled, mottled, lineated and irregular. Two rock units may have the same tone but different textures.

Shadows are useful in identification of building, tower, and trees as well as helpful in geomorphological studies where microrelief features may be easier to detect under conditions of low-angle solar illumination than when the sun is high in the sky. Unfortunately, deep shadows in areas of complex detail may obscure significant features, e.g. the shadow of cloud. Likewise, the repetitive patterns of both natural and cultural features also help to identify the objects. Such features include agricultural complexes (e.g. farms and orchards) and terrain features like terraces on opposite sides of the river valleys.

Sharpness of the image is the abruptness with which tone or color contrasts appear on the photograph or the imagery. This also greatly helps an interpreter to distinguish one object from another. More importantly, resolution of a sensor system, which is its capability to discriminate two closely

spaced objects from each other, is one of the primary factor controlling how efficiently and accurately we can identify the objects on an image/photo. Satellite imageries with varying resolution like spatial, spectral and temporal resolutions are available and the user should decide the required resolution for their purpose. The process, by which related conditions are established by inference, is termed "convergence of evidence", which is carried out at the final stage of image interpretation leading to identification of objects on the image/photograph. Thus, the image interpretation is the deductive process, and the identification of certain key features leads to the recognition of others. The completeness and accuracy of the results depend on an interpreter's ability to integrate such elements in the most appropriate way to achieve the objectives that have been set for them.

Stereoscopic Appearance

When the same feature is photographed from two different positions with overlap between successive images, an apparently solid model of the feature can be seen under a stereoscope. Such a model is termed a stereo-model and the obtained three-dimensional view can aid interpretation. Most of the aerial photographs are produced in stereopair while satellite images only of some sensors are available in stereopair images.

THE GIS TOOL

A Geographic Information System (GIS) is an innovative tool and it has diverse range of applications in various subjects. Fundamental to the concept of GIS is the integration between tabular and cartographic data, at a variety of scales in a common platform related to location. This ability to integrate and analyze the spatial and the attribute data provide a powerful tool for the spatial analysis. GIS also provides a setting to overlay data layers, perform spatial queries and carry out raster based and vector based analysis.

The data like geomorphological features including the landslide, socio-environment, land use data, geology, engineering geology and so on could be the basic information that can be stored and mapped to which the structures of hydropower project can be overlain for better visualization of its relationship with those parameters. Similarly, the existing paper maps can be transformed and digitized to prepare thematic layers.

SOME EXAMPLES OF USE OF GEOSPATIAL TOOL FOR HYDROPOWER SITE EVALUATION

Overlaying project structures on the satellite image/aerial photograph helps for evaluation of project structures with respect to terrain condition (Fig. 2). This step primarily helps to identify the area in which the project structures are going to be constructed. Likewise, the geological boundaries can be demarcated that gives an idea on various geological units covered by the project.

Fig. 2: Project structures overlain on the aerial photograph with geological boundary.

Fig. 3: Project structures overlain on the map showing the distribution of various soil types.

Fig. 4: Detailed assessment of the headworks area.

Detailed observation of soil and rock condition in and around the project site can be made. This is especially important to observe the ground condition on which the project structures are being constructed. The headworks area, canal/pipe alignment as well as powerhouse sites are important locations to be considered for evaluation of the project site condition. The data collected in field as well as interpreted from the remote sensing data can be the basis for preparation such map (Fig. 2 and Fig. 3). Such information is vital for design engineers to appropriately design required structures based on the ground condition, which is minutely available from such map. The appropriateness of the canal/pipe alignment is another important factor to evaluate the feasibility of the project. The alignment should be through appropriate terrain condition in terms of gradient and stability of the ground surface. Such condition can be preliminarily evaluated through the study of satellite imageries or aerial photograph followed by field verification.

Likewise, the details of the particular project site can be explored through the study of imageries/photographs. The suitability of the headworks area, which primarily includes diversion weir and desander can be made with the study of remotely sensed data (Fig. 4). The foundation of the diversion weir is ideally expected to be at the stable location. The presence of rock or soil and possible geodisaster from upstream and surrounding plays vital role to decide its appropriateness. This can be easily evaluated from the study of remote sensing data. In addition, there should be sufficient space for the construction of desander and it should be safe against the landslide, flood and other disastrous consequences. The appropriateness of powerhouse site is evaluated based on its elevation, spaciousness to host various structures, adjacent slope stability condition, possible impact from floods etc. The preliminary identification of such site can be made through the study of aerial photo or satellite image of the area having reasonable resolution to extract required information (Fig. 5).

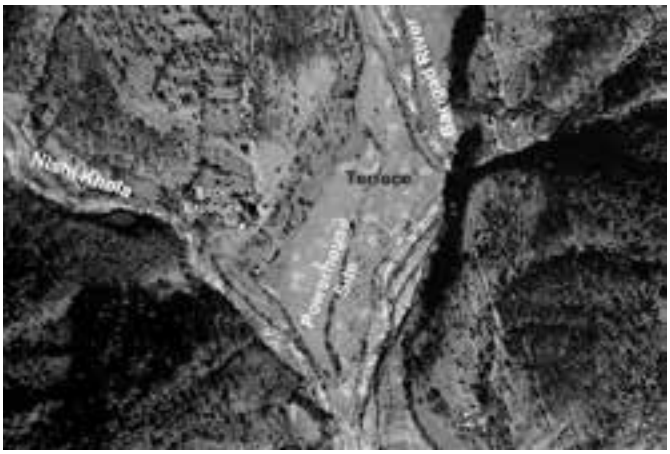

Fig. 5: Detailed assessment of the powerhouse area.

CONCLUSION

The use of remote sensing data (satellite image or aerial photograph) is important for site selection for the hydropower project. The use of this resource can have significant use at the pre-feasibility/feasibility stage of the study as the evaluation of site at the watershed level can be done prior to mobilization to the field. The information extracted and stored in GIS followed by interpretation with updation through field study helps to make decision on the appropriateness of the various locations for project structures. Thus, geospatial techniques can be an effective tool to assess the economically viable and technically sound hydropower project site.

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रमिते चौरको रमाइलो प्रसङ्ग

पदमकुमार राई

(पूर्व विज्ञान शिक्षक, ने. भौ. स. आजीवन सदस्य ५४८)

वर्षमा एकपटक आमा मावला जानुहुन्थ्यो । त्यसैले वर्षमा एकपटक म पनि आमासँगै मावला जान पाउथेँ । सानो छँदा मावला जाने इच्छा धेरै अनि जान पाउँदाको खुशी धेरै । भोजपुर जिल्लामा रहेको मेरो मावली गाउँ 'खावा', पुग्न खोटाङ जिल्लामा रहेको मेरो गाउँबाट पूरै एकदिन हिँड्नु पर्थ्यो । मावला आवतजावत गर्दा मावलीगाउँ खावाको थाप्लोमा रहेको 'रमिते चौर' वारपार गर्नुपर्थ्यो । खावा गाविस वडा नं. ६ मा रहेको वारिला वनको थाप्लोमा रमिते चौर अन्दाजी २०० मिटर लामो र १०० मिटर चौडा थियो । चौरको बिचमा दुईवटा खाल्टाहरू थिए । ती खाल्टाहरूमा धेरै गहिराईदेखि आएको जमिनको सुसाइ सुनिन्थ्यो । मावला आवतजावत गर्दा ती खाल्टाहरूबाट आउने सुसाइ सुन्दै हामी पार हुन्थ्यौं । चौरमा छोटो समयका लागि भए पनि भकुण्डो खेल्न रमाइलो लाग्थ्यो । खाल्टाहरू चौरको बिचमा भएको हुनाले भकुण्डो घरिघरि खाल्टाहरूमा परिरहन्थ्यो । भकुण्डो झिक्न जाँदा खाल्टोको पीँधको चिरावाट सुनिने सुसाइ सुनेरमात्र भकुण्डो झिक्ने गथ्यौं । उक्त खाल्डोको सुसाइ वि.सं. २०२४ सम्म सुनिन्थ्यो । माटोले पुरिदै गएकोले अहिले सुनिन छाडेको छ । मामाघर आवतजावत गर्दा, रमिते चौरमा भकुण्डो खेल्दा ती खाल्टाहरूका बारेमा हामीलाई थाहा थिएन । अहिले म यकिनका साथ भन्न सक्छु ती खाल्टाहरू वि.सं. १९९० सालका परिणाम रहेछन् ।

तथ्यहरू :

१. रमिते चौरको बीचमा अति नजिक रहेका दुई खाल्टाहरू १९९० सालको भूकम्प भन्दा अगाडि त्यस स्थानमा नरहेको ।
२. पहिले रमिते चौरसम्म रहेको र भूकम्प हुँदा खाल्टो उत्पन्न भएको भाग केही तलतिर धसिएको र वरपरको भाग केही उठेको ।
३. रमिते चौरको दक्षिण–पश्चिम किनारमा जमिन फुटेर एक मिटर जति तलमाथि भएको ।
४. मेरी आमा दीपहीरा राई र बुबा मन्दिरमान राईको शुभविवाह १९९० सालको महाभूकम्पको दिनमा भएको थियो । बुबा र आमा जन्तिसँग रमिते चौर आइपुग्दा भूकम्प गएको रहेछ । भूकम्पले सबैलाई जमिन भन्दा माथि तिर फ्याँकेको र जमिनमा झरेपछि भूकम्प भइन्जेल उठ्न नसकेको कुरा कहिलेकाहिँ हामी पाीवारका सदस्यहरूलाई सुनाउनु हुन्थ्यो ।

यी माथि उल्लेखित तथ्यहरूको आधारमा १९९० सालको महाभूकम्पको इपिसेन्टर भोजपुर जिल्लाको खावा गाविसको वडा नं. ६ मा पर्ने रमिते चौर हो भन्न सकिन्छ । यसको पुष्टिका लागि राष्ट्रिय भूकम्प मापन केन्द्र, लैनचौर, काठमाडौं र नेपाल भौगर्भिक समाजका भूवैज्ञानिकहरूको विषेशज्ञता आवश्यक छ । पुष्टि भएपछि वि.सं. १९९० को महाभूकम्पको केन्द्रविन्दु किटेर उल्लेख गर्न सकिने छ ।

नेपाल भौगर्भिक समाज

हार्दिक श्रद्धाञ्जली

जन्म
वि. सं. १९९८ फागुन

स्वर्गारोहण
वि. सं. २०७२ फागुन २३

स्व. प्रा. डा. माधव प्रसाद शर्मा

कोशी अञ्चल धनकुटा जिल्ला लेगुवा गाउँ विकास समितिमा पिता लक्ष्मी प्रसाद शर्मा र माता दिव्य कुमारी शर्माको कोखबाट वि. सं. १९९८ फागुनमा जन्मनु भएका वरिष्ठ भू-गर्भशास्त्री **प्रा. डा. माधव प्रसाद शर्मा**को २०७२ फागुन २३ गते ७४ वर्षको उमेरमा हुन गएको असमयिक निधनले नेपाल भौगर्भिक समाज तथा समाजका सम्पूर्ण सदस्यजन अत्यन्त मर्माहत भएका छौं । वि. सं. २०२४ मा नेपालमा पहिलो पटक त्रि-चन्द्र बहुमुखी क्याम्पसमा भू-गर्भ विज्ञानको स्नातकतहको अध्ययनको स्थापना गरि संस्थापक प्राध्यापकको रुपमा प्राशिक क्षेत्रमा प्रवेश गर्नु भई आफ्नो जीवनभर भू-गर्भ विषयको विकास र प्रवर्द्धनमा अभिभावकको भूमिकामा रहनु भएका नेपाल भौगर्भिक समाजका आजीवन तथा सम्मानित सदस्यबाट विभूषित **प्राध्यापक शर्मा**ले त्रिभुवन विश्व विद्यालयको शिक्षाध्यक्ष र उपकुलपति भई नेपालको शिक्षा क्षेत्रमा समेत योगदान पुऱ्याउनु भएकोमा सम्पूर्ण भू-गर्भ शास्त्रीहरुले गौरवको अनुभूति गरेका छौं । सरल, शालीन, मिलनसार एवं कर्तव्यनिष्ठ यस्ता मूर्धन्य व्यक्तित्वको असमयिक निधनले नेपाल भौगर्भिक समाजलाई अपूरणीय क्षति पुगेको अनुभव गरेको छ । नेपालमा भूगर्भशास्त्र एवं शिक्षा क्षेत्रको प्राशिक उन्नयनमा उहाँले दिनु भएको योगदान स्वर्णाक्षरमा लेखिएको छ ।

यस दुःखद घडीमा नेपाल भौगर्भिक समाज तथा समाजका सम्पूर्ण सदस्यजन दिवङ्गत आत्माको चिर शान्तिको कामना तथा भावपूर्ण श्रद्धाञ्जली अर्पण गर्नुको साथै उहाँको धर्मपत्नी श्रीमती मिरा शर्मा एवं छोरीहरु सुनी कोईराला र शिवानी पौडेल तथा सम्पूर्ण परिवारजन, इष्टमित्र र आफन्तमा धैर्य धारण गर्ने शक्ति मिलोस् भन्ने कामनाका साथ हार्दिक समवेदना व्यक्त गर्दछौं ।

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अध्यक्ष
नेपाल भौगर्भिक समाज

डा. प्रेमबहादुर थापा
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नेपाल भौगर्भिक समाज

मिति: २०७२ फागुन २२

Upoming Events...

8th Nepal Geological Congress

Nepal Geological Society (NGS) is a professional geo-scientific organization with over 800 members and nearly one third of them are international scientists. The Society is the National Group Member of International Association of Engineering Geology and the Environment (IAEG) and was member of Nepal National Committee on International Decade for Natural Disaster Reduction (IDNDR) to led the IDNDR activities in Nepal for a decade. The Society was honored with: the 1998 United Nations Sasakawa Disaster Prevention Award Certificate of Merit in appreciation for its contribution to disaster prevention, mitigation and preparedness and Science and Technology Promotion Award from Nepal Academy of Science and Technology (NAST) in recognition of its contribution in the research and promotion of geo-science. Since its establishment, NGS is providing platforms for scientists from all the continents to present research findings and exchange professional experiences and views on various aspects of geo-science. It has successfully organized 7th Nepal Geological Congresses and a number of regional and international symposiums, conferences and workshops in the past, including the IAEG international symposium on 'Engineering Geology, Hydrogeology and Natural Disaster' in 1999 and the Fifth Asian Regional Conference on 'Engineering Geology for Major Infrastructure Development and Natural Hazards Mitigation' in 2005. All these scientific events have provided NGS a foundation for building effective geo-scientific cooperation among the geoscientists of the Himalaya, Tibet and Karakoram regions and other parts of the world. As part of its scientific activities this year, NGS is going to organize the 8th Nepal Geological Congress from November 27-29, 2016 to exchange expertise, experiences and knowledge for building effective cooperation among the geoscientists of all over the world. The 2015-Gorkha earthquake (Mw 7.8 main shock on April 25 and Mw 7.3 aftershock on May 12) that caused over 9000 deaths and huge destruction is one of the main focuses of the Congress. The Congress will be followed by four excursions.

THEME AND SUB-THEMES

The main theme of the Congress is: "Geoscience in National Development and Disaster Management". Sub-themes of the 8th Congress include:

- Regional Geology, Stratigraphy and Tectonics
- Quaternary Geology and Urban Geology
- Seismology and Seismotectonics
- Remote Sensing and Geodesy
- 2015-Gorkha Earthquake
- Hydrogeology
- Mineral Resources and Mining, Oil and Natural Gases
- Exploration Geophysics and Geochemistry
- Climate Change and Environmental Assessment
- Engineering Geology and Infrastructural Development
- Geo-Hazards and Risk Management
- Geo-science Education, Geo-park and Geo-heritage Conservation

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For Further information Please visit following website:
http://www.ngs.org.np

Upcoming Events...

IAEG meeting in Kathmandu organized by Nepal Geological Society

Nepal Geological Society (NGS) was affiliated with International Association for Engineering and the Environment (IAEG) from last 20 years. This year NGS revised its IAEG National Group memberships and reshuffled national group coordinating team. NGS appointed Dr. Ranjan Kumar Dahal as National Group Coordinator, Dr. Prem Bahadur Thapa as Member Secretary and Mr. Subas Chandra Sunuwar as Member of IAEG National Group Sub Committee. This year, NGS started IAEG national group membership drives and number of national group members increased, drastically. Now, IAEG Nepal National Group has 53 members, out of them, 47 members are without bulletin and 6 members are with bulletin.

Similarly, IAEG Nepal National Group coordinator participated in council meeting of IAEG during the EGNM 2015 at Delhi and won a chance to organize 11th Asian Regional Conference in Kathmandu. Now, NGS has formed organizing committee for 11 ARC and preparing all provisions for the Conference.

This year Nepal National Group is revitalizing IAEG activities in Nepal. We are sure that in coming days, we will come with new programs and schedules.

The 11th Asian Regional Conference (ARC) of IAEG

In 2015 October, National Group Coordinator Dr. Ranjan Kumar Dahal and IAEG Nepal national group member Mr. Kumud Raj Kafle has participated in Council meeting of IAEG in New Delhi and submitted nomination of NGS to organize the 11th Asian Regional Conference (ARC) of IAEG in Kathmandu on 2017. NGS is selected by 18/31 votes to organize 11th ARC. This was a great win of Nepal against Malaysia.

Figure Council meeting of IAEG in Delhi, October 2015.

NGS has now decided date of ARC-11. On 28-30 November, 2017, NGS is going to organize 11th ARC of IAEG and hopefully it will be one of the much successful events of NGS. Detail of this conference is available in www.iaegarc11ngs.com. First circular of ARC-11 is already published and National Group Coordinator Dr. Ranjan Kumar Dahal who is also co-convener of ARC-11, is going to present conference report in council meeting of IAEG during 35th International Geological Congress (IGC) in Capetown on 29 August 2016.

List of IAEG Nepal National Group Members

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Dr. Bhupati Neupane
Dr. Dinesh Pathak
Dr. Khum Narayan Paudayal
Dr. Manita Timilsina
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Dr. Rama Mohan Pokharel
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Dr. Subodh Dhakal
Dr. Sunil Kumar Dwivedi
Dr. Upendra Baral
Dr. Ashok Sigdel
Dr. Basanta Adhikari
Dr. Danda Pani Adhikari
Dr. Deepak Chamlagain
Dr. Ganesh Raj Joshi
Dr. Kabi Raj Paudyal
Dr. Kamala Kant Acharya
Dr. Krishna Devkota
Dr. Naresh Kazi Tamrakar
Dr. Prakash Das Ulak
Mr. Achyuta Koirala
Mr. Bishwanath Ray Chaudhary
Mr. Kumud Raj Kafle
Mr. Mukunda Raj Poudel
Mr. Narayan Gopal Ghimire
Mr. Om Pradhan
Mr. Prafulla Man Pradhan
Mr. Rabindra Prasad Dhakal
Mr. Rupak Sthapit
Mr. Sagar Ratna Bajracharya
Mr. Samjwal Ratna Bajracharya
Mr. Shiva Raj Bhandari
Mr. Sobit Thapaliya
Mr. Subhas Chandra Sunuwar
Mr. Sujan Raj Adhikari
Mr. Jagadiswar Shrestha
Mr. Kangada Prasai
Mr. Krishna Prasad Kafle
Mr. Lok Bijay Adhikari
Mr. Madan Pokharel
Mr. Moti Bahadur Kunwar
Mr. Prayag Maharjan
Mr. Purusottam Shilpakar
Mr. Raghu Nath Wagle
Mr. Surya Limbu
Mr. Tara Bhattarai
Prof. Dr. Lalu Poudel
Prof. Dr. Prakash Chandra Adhikari
Prof. Dr. Taranidhi Bhattarai
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NEW MEMBERS OF THE NEPAL GEOLOGICAL SOCIETY

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30	LM-760	Kedar SHRESTHA	Budhanilkhntha-04, Kathmandu	ked_sth05@yahoo.com

CONGRATULATIONS

Nepal Geological Society extends its heartiest congratulations to the following members of the Society for their achievements (Promotions, Awards, New Jobs etc.)

PROMOTIONS/APPOINTMENTS

Prof. Dr. Tara Nidhi Bhattarai
(LM 198)
Appointed by Government of Nepal as the member of the steering committee of the Nepal Reconstruction Authority, Nepal Government

Date of appointment: 2072.09.21

Mr. Moti Bahadur Kunwar
(LM 103)
Appointed by Government of Nepal for the post of Executive Director (CEO) of Nalsing Gad Sorage Hydropower Project for four years

Date of appointment: 2073.04.14

Sarbajit Prasad Mahato
(LM 219)
Promoted as the Secretary of Ministry of Peace and Reconstruction, Nepal Government

Date of promotion: 2073.02.02

Dr. Rajendra Bhandari
(LM 332)
Promoted to the post of Joint Secretary (Superintendent Geologist) of the Nepal Government

Date of promotion: 2072.11.04

Mr. Churna Bahadur Wali
(LM 407)
Promoted to Deputy Director General (Superintendent Hydrogeologist), Department of Irrigation, Jawalakhel, Lalitpur

Date of promotion: 2072.11.4

Mr. Deepak Ghimire
(LM 343)
Promoted to Director (Superintendent Hydrogeologist), Groundwater Irrigation Directorate, Chitwan

Date of promotion: 2072.10.15

Mr. Ram Prasad Ghimire
(LM 612)
Promoted to Deputy Director General, Department of Mines and Geology, Ministry of Industry, Government of Nepal

Date of promotion: 2072.12

Mr. Sudhir Rajaure
(LM 345)
Promoted to Superintendent Geologist, Department of Mines and Geology, Ministry of Industry, Government of Nepal

Date of promotion: 2072.11.04

PROMOTIONS/APPOINTMENTS

Mr. Suresh Shrestha
(LM 617)
Promoted to Senior Divisional Geologist Nepal Government

Date of promotion: 2072.03.28

Mr. Shiva Kumar Baskota
(LM 620)
Promoted to Senior Divisional Geologist Nepal Government

Date of promotion: 2073.02.02

Mr. Amar Bahadur Chand Thakuri

Promoted to Division Chief (Senior Divisional Hydrogeologist), Groundwater Irrigation Development Division, Mahottari

Date of promotion: 2071.11.12

Mr. Mahesh Pokharel
(LM 536)
Promoted to Division Chief (Senior Divisional Hydrogeologist), Groundwater Irrigation Development Division, Sarlahi

Date of Promotion: 2071.11.29

Mr. Krishna Prasad Upadhyay
(LM 584)
Promoted to Division Chief (Senior Divisional Hydrogeologist), Ministry of Irrigation, Sinha Durbar, Kathmandu

Date of promotion: 2071.11.28

Ms. Pramila Shrestha
(LM 560)
Promoted to Senior Divisional Hydrogeologist, Department of Irrigation, Jawlakhel, Lalitpur

Date of Promotion: 2073.01.31

Mr. Ajaya Raj Adhikari
(M 561)
Promoted to Senior Divisional Hydrogeologist. (Presently doing masters at the University of New South Wales, Australia)

Date of promotion: 2072.1.11

Mr. Gautam Prasad Khanal
(LM 702)
Appointed as a geologist at Department of Mines and Geology. Ministry of Industry, Nepal Government

Date of appointment: 2072.05.09

PROMOTIONS

Prof. Dr. Tara Nidhi Bhattarai
(LM 198)
Promoted to Full Professor of Geology, Tribhuvan University, Tri-Chandra Campus, Kathmandu Nepal.

Prof. Dr. Suresh Das Shrestha
(LM 156)
Promoted to Full Professor of Geology, Tribhuvan University, Central Department of Geology, Kirtipur, Kathmandu Nepal.

Dr. Ananta Prasad Gajurel
(LM 271)
Promoted to Associate Professor of Geology, Tribhuvan University, Tri-Chandra Campus, Kathmandu Nepal.

APPOINTMENT

Mr. Narendra Dhoj Maskey
(LM 104)
Reappointment of the Chair of the East-West Center Association Executive Board in Honolulu, Hawaii, for one year term from 1 July, 2016 to 30 June,2017.

Mr. Ashish Ratna Shakya
(LM 579)
Promoted for the post of Deputy Manager in Upper Trishuli 3 'A' HEP, Nepal Electricity Authority (from 1st Ashwin 2072).

Mr. Sanjeev Regmi
(LM 605)
Promoted to assistant manager at the Soil, Rock and Concrete Laboratory, Nepal Electricity Authority, Bhagawanpau, Swoyambhu.

Ph. D. AWARDS

Dr. Ram Prasad Sharma
(LM 492)
Institute: Forest Research Institute (Deemed) University, Kaulagarh Road, Dehra Dun, India
Thesis Title: Assessment of Carbon Sequestration in Community Managed Forest of Nepal
Year of Ph. D. Award: 2015

Dr. Ajit Joshi
(LM 603)
Institute: University of Missouri, USA
Thesis Title: Numerical modelling of porosity waves as a mechanism for rapid fluid transport in elastic porous media.
Year of Ph. D. Award: 2015

Dr. Subodh Khanal
(LM 547)
Institute: University of Alabama, USA
Thesis Title: Structural and kinematic evolution of the Himalayan Thrust Belt, Central Nepal.
Year of Ph. D. Award: 2014

Dr. Hari Prasad Kadel
(LM 588)
Institute: Florida International University, USA
Thesis Title: Landuse/landcover driven surface energy balance and convective rainfall change in South Florida.
Year of Ph. D. Award: 2015

LIST OF BOOKS PUBLISHED BY THE NGS

1. The Himalaya-Tibet Collision, 2013

Georges Mascle, Arnaud Pêcher Stéphane Guillot, Santa Man Rai & Ananta P. Gajurel
Preface By Patrick Le Fort

Nepal Geological Society, Sociétê Géologique De France Vuibert

2. Report on The Geological Survey of Nepal

By Toni Hagen

Volume I: PRELIMINARY RECONNAISSANCE Attached Plates 1969

Reprinted by Nepal Geological Society, Kathmandu, Nepal, 2013

3. Report on The Geological Survey of Nepal

By Toni Hagen

Volume II: GEOLOGY OF THE THAKKHOLA including adjacent areas

Reprinted by Nepal Geological Society, Kathmandu, Nepal, 2014

LIST OF PUBLISHED JOURNALS OF NEPAL GEOLOGICAL SOCIETY

1. Journal of Nepal Geological Society, Vol. 48, 2015, Speical issue, abstract of the 7th Nepal Gelogy Congress
2. Journal of Nepal Geological Society, Vol. 47, 2014
3. Journal of Nepal Geological Society, Vol. 46, 2013
4. Journal of Nepal Geological Society, Vol. 45, Speical issue, abstract of the 27th HKTW 2012
5. Journal of Nepal Geological Society, Vol. 44, 2012
6. Journal of Nepal Geological Society, Vol. 42, 2011
7. Journal of Nepal Geological Society (Abstract of Sixth Nepal Geological Congresss on Geology, Natural Resources, Infrastructure, Climate Change and Natural Disasters, 15-17 November 2010, Vol. 41 (Special isssue), November, 2010
8. Journal of Nepal Geological Society, Vol. 39, June 2009
9. Journal of Nepal Geological Society (Proceedings of International Workshop on Seismology, Seismotectonics, and Seismic Hazard in Nepal Himalaya, 28–29 November 2006 and Fifth Nepal Geological Congress on Geology, Environment, and Natural Hazards Mitigation: Key to National Development, 26–27 November 2007), Vol. 38 (Special Issue), December 2008
10. Journal of Nepal Geological Society, Vol. 37, June 2008
11. Journal of Nepal Geological Society (Abstracts of Fifth Nepal Geological Congress on Geology, Environment, and Natural Hazards Mitigation: Key to National Development, 26–27 November 2007), Vol. 36 (Special Issue), November 2007
12. Journal of Nepal Geological Society, Vol. 35, June 2007
13. Journal of Nepal Geological Society (Proceedings of Fifth Asian Regional Conference on Engineering
14. Geology for Major Infrastructure Development and Natural Hazards Mitigation, 28–30 September 2005),
15. Vol. 34 (Special Issue), December 2006
16. Journal of Nepal Geological Society, Vol. 33, June 2006
17. Journal of Nepal Geological Society (Abstracts of Fifth Asian Regional Conference on Engineering Geology for Major Infrastructure Development and Natural Hazards Mitigation, 28–30 September 2005), Vol. 32 (Special Issue), September 2005
18. Journal of Nepal Geological Society, Vol. 31, June 2005
19. Journal of Nepal Geological Society (Proceedings of Fourth Nepal Geological Congress, 9–11 April 2004), Vol. 30 (Special Issue), December 2004

20. Journal of Nepal Geological Society, Vol. 29, June 2004
21. Journal of Nepal Geological Society, Vol. 28, June 2003
22. Journal of Nepal Geological Society (Proceedings of Third Nepal Geological Congress, 26–28 September 2001, Kathmandu, Nepal), Vol. 27 (Special Issue), December 2002
23. Journal of Nepal Geological Society, Vol. 26, June 2002
24. Journal of Nepal Geological Society (Proceedings of Workshop on the Himalayan Uplift and Palaeoclimatic Changes in Central Nepal, 10 November 2000), Vol. 25 (Special Issue), December 2001
25. Journal of Nepal Geological Society (Abstract Volume of Third Nepal Geological Congress, 26–28 September 2001), Vol. 24 (Special Issue), September 2001,
26. Journal of Nepal Geological Society, Vol. 23, June 2001
27. Journal of Nepal Geological Society (Proceedings of International Symposium on Engineering Geology, Hydrogeology, and Natural Disaster with Emphasis on Asia, 28–30 September 1999, Kathmandu, Nepal),
28. Vol. 22 (Special Issue), December 2000
29. Journal of Nepal Geological Society, Vol. 21, June 2000
30. Journal of Nepal Geological Society (Abstract Volume of International Symposium on Engineering Geology, Hydrogeology, and Natural Disaster with Emphasis on Asia, 28–30 September 1999, Kathmandu, Nepal), Vol. 20 (Special Issue), 1999
31. Journal of Nepal Geological Society, Vol. 19, 1999
32. Journal of Nepal Geological Society (Proceedings of Second Nepal Geological Congress, 1995), Vol. 18 (Special Issue), 1998
33. Journal of Nepal Geological Society, Vol. 17, 1997
34. Journal of Nepal Geological Society (Abstract Volume of Second Nepal Geological Congress), Vol. 16 (Special Issue), 1997
35. Journal of Nepal Geological Society, Vol. 15, 1997
36. Journal of Nepal Geological Society (Proceedings of First Nepal Geological Congress, 1995), Vol. 14 (Special Issue), 1996
37. Journal of Nepal Geological Society, Vol. 13, 1996
38. Journal of Nepal Geological Society (Abstract Volume of First Nepal Geological Congress, 1995), Vol. 12 (Special Issue), 1995
39. Journal of Nepal Geological Society (Proceedings of 9th Himalaya–Karakoram–Tibet Workshop, 1994), Vol. 11 (Special Issue), 1995
40. Journal of Nepal Geological Society, Vol. 10, 1995
41. Journal of Nepal Geological Society (Abstracts of 9th Himalaya– Karakoram–Tibet Workshop, 1994), Vol. 10 (Special Issue), 1994 29
42. Journal of Nepal Geological Society, Vol. 9, 1993
43. Journal of Nepal Geological Society, Vol. 8, 1992
44. Journal of Nepal Geological Society, Vol. 7, 1991
45. Journal of Nepal Geological Society, Vol. 7 (Special Issue), 1991
46. Journal of Nepal Geological Society, Vol. 6, 1989
47. Journal of Nepal Geological Society, Vol. 5, No. 1, 1988
48. Journal of Nepal Geological Society, Vol. 4 No. 1 & 2, 1987
49. Journal of Nepal Geological Society, Vol. 4 (Special Issue), 1984*
50. Journal of Nepal Geological Society, Vol. 3, No 1 & 2, 1985
51. Journal of Nepal Geological Society, Vol. 2 No. 2, 1985
52. Journal of Nepal Geological Society, Vol. 2 (Special Issue), 1982*
53. Journal of Nepal Geological Society, Vol. 2, No. 1, 1981
54. Journals of Nepal Geological Society, Vol. 1, No. 2, 1981*
55. Journal of Nepal Geological Society, Vol. 1, No. 1, 1981*

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***Bulletin of Nepal Geological Society (Vol. 1 to Vol. 33)**

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The manuscripts and all the correspondences regarding the Journal of Nepal Geological Society should be addressed to the Chief Editor, Nepal Geological Society, PO Box 231, Kathmandu, Nepal (Email: publication@ngs.org.np).

The acceptance or rejection of a manuscript is based on appraisal of the paper by two or more reviewers designated by the Editorial Board. Critical review determines the suitability of the paper, originality, and the adequacy and conciseness of the presentation. The manuscripts are returned to the author with suggestions for revision, condensation, or final polish.

After the manuscript has been accepted, the editors will ask the author to submit it in an electronic format for final processing. Manuscripts are copy edited. Final changes must be made at this time, because no galley proofs are sent to authors.

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Auden, J. B., 1934, Traverses in the Himalaya. Rec. Geol. Surv. India, v. 69(2), pp. 123–167.

Todd, D. K., 1980, *Groundwater Hydrology*. John Wiley & Sons, Singapore, 535 p.

Tokuoka, T. and Yoshida, M., 1984, Some characteristics of Siwalik (Churia) Group in Chitwan Dun, Central Nepal. Jour. Nepal Geol. Soc., v. 4, (Sp. Issue), pp. 26–55.

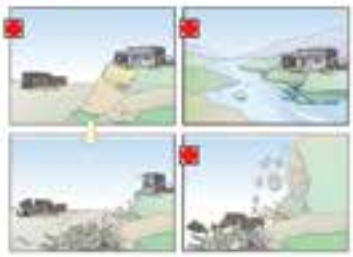
भूकम्प प्रतिरोधी निर्माण नमूना

Earthquake Resistant Construction Model

(काठको ब्याण्डको प्रयोग)

दुङ्गा माटोको घरलाई भूकम्प प्रतिरोधी बनाउन ध्यान दिनुपर्ने १० मुख्य कुराहरू

१ निर्माण स्थलको छनौट र परीक्षण



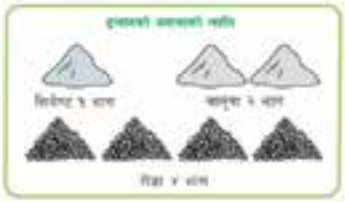
निर्माणस्थलमा पानी नजम्ने, ढुङ्गा नखस्ने, पहिरो नजाने ठाउँमा हुनुपर्छ ।

२ आवासको आकार प्रकार र लाप

साधारण र नियमित आकारको घर बनाउनु पर्छ । घर एक तलासम्म सिमित राख्नु पर्छ ।

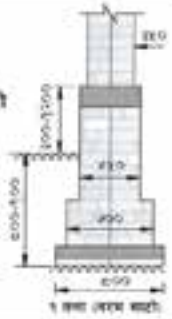
३ निर्माण सामग्रीहरु

पाटा मिसेका ढुङ्गाहरु प्रयोग गर्नुपर्छ । ढुङ्गाका सलाकाको प्रयोग गर्दा माथा मिलाएर प्रयोग गर्नुपर्छ ।



४ जग

जग कम्तीमा ९० से.मि. गहिरो र ८० से.मि. चौडा हुनुपर्छ ।



५ जारो

गारोको अधिकतम लम्बाइ ४.५ मि. भन्दा बढी हुनु हुदैन । ४.५ मि. भन्दा लामो भएमा टेका गारो राख्नुपर्छ ।

६ झ्याल र ढोकाहरु

भूकम्प र ढोका गारोको कुनाबाट कम्तीमा ६० से.मि. छोड्नेर राख्नु पर्दछ । भूकम्प र ढोका ठुला र धेरै राख्नु हुदैन ।

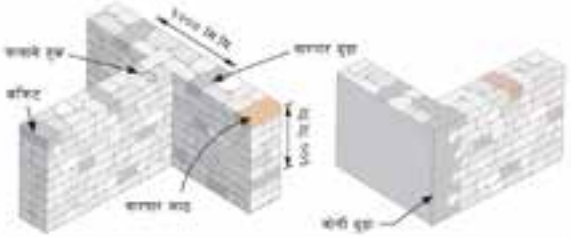
७ तेर्सो पट्टीहरु

भवनमा जग, जगको माथिल्लो सतह, भूकम्पढोकाको तल्लो र माथिल्लो सतह तथा छानाको तहमा पुरै गारो भरि तेर्सो पट्टीहरु दिनुपर्छ ।

बन्धन र तेर्सो पट्टीहरु राख्ने तरिका

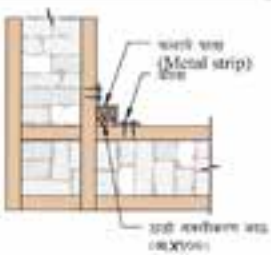
७ जारो निर्माण तरिका

ढुङ्गाको गारोमा ठाउँ ठाउँमा पुरै गारोको चौडाइ भरिको कैंची मार्ने ढुङ्गाहरु राखिएको हुनुपर्छ । सुर र जोर्नीहरुमा टुक्रो चाक्लो ढुङ्गाको प्रयोग गर्नुपर्छ ।



८ ठाडो फलामे छड्कीहरु/काठ

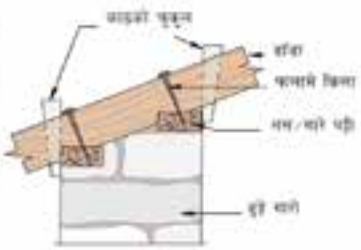
घरको बढी असर पर्ने ठाउँहरु जस्तै कुना, जोर्नी र भूकम्पढोकाको छेउमा ठाडो फलामको ढुवहरु हाल्नु पर्दछ । ठाडो फलामे ढुवडी नभाएको खण्डमा काठ प्रयोग गर्न सकिन्छ ।



ढुङ्गाको गारोमा ठाडो काठ राख्ने तरिका

१० छाना र तल्लाहरु

छाना तथा तल्लाहरु गारोलाई उपयुक्त तरिकाले बाँधेको हुनुपर्दछ । छाना तथा तल्ला मजबुत पार्न खप छड्के काठ वा फलाम प्रयोग गरी चौकुने बन्धन राख्नुपर्छ ।



भूकम्प प्रविधि राष्ट्रिय समाज-नेपाल

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फोन नं.: (९७७-१) ५५९१०००, फ्याक्स नं.: (९७७-१) ५५९२६९२,

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